

SCIENTIFIC FACTORY MANAGEMENT

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To

MY MOTHER

for a transmitted regard for others

MY FATHER

for inculcated discipline and a zest for work

MY UNIVERSITIES

*especially Birmingham, for developing a tendency
towards comprehensive surveys*

MY FRIENDS

*among Capital, Labour, and Bookmen, for a
strengthened sense of relative proportions*

MY DIRECTORS

*for unchallenged facilities in the preparation of
a book they knew of, but knew not*

*I dedicate this effort to get the great
task of to-day in a correct perspective.*

“THE mind, to be kept in health, must be kept in exercise. Analytical reasoning is a base and mechanical process, which takes to pieces and examines bit by bit the rude materials of knowledge and extracts therefrom a few hard and obstinate things called facts.”

THOMAS LOVE PEACOCK.

FOREWORD

READER, you will get from this book new cross-lights on factory management—incentives to a scientific treatment of industry in place of the old rules of thumb, and inducements to follow the scientist's plan of analysis and synthesis.

Whilst purposely abstaining from dipping too deeply into details, I have striven to fashion a framework of principles into a structure that will not only bear critical examination, but will also interest and inform and maybe shape and sharpen the thoughts of my readers, be they plutocrat, bureaucrat, or proletariat. That my various conclusions will be accepted without challenge, or my cross-lights be all approved, I do not for a moment expect : but that my main outline will stand the unmerciful test of time, I feel confident.

The substance of the several chapters has formed part of various lectures—at the London School of Economics, the Manchester College of Technology, and elsewhere. In its preparation I have drawn liberally on the experience of men the world over, but wish to acknowledge in particular my indebtedness to the authors whose books are listed in Appendix I., and to C. L. Green of Stafford for his assistance in reading proofs.

A. D. D.

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CHAPTER I

ORGANISATION : PAST AND FUTURE

IN this old country there are some of the best people God ever made—big, clean, straight MEN. Their main fault is conservatism ; their greatest handicap a defective education ; their chief obstacle the cursed conventions that cling like barnacles to the established order.

But the old order is in the melting-pot. Industry has been overstrained. Managers, superintendents, and foremen everywhere have been drawn to the snapping-point, and the workers keyed to the highest pitch. Muscles have been on the stretch. Minds have been on the stretch. Imagination is on the stretch. Moulding the new order.

Somewhere inside us the war has awakened a vague unscientific sense that a great many things are wrong. The Hindenburg line of industrial conventions has been smashed—in places. Therein lies the danger. Forward

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positions have to be consolidated and rapid advances skilfully co-ordinated. Those twin hindrances to progress, ignorance and custom, have to be circumvented. For this work the nation wants, as it never wanted before, the united efforts of its big-hearted, clean-minded, straight-talking citizens.

You and I, reader, have to help mould the new order. For men in industry—captains, leaders, executives, managers, foremen, and workers—have it within their power more than any other group of people to save mankind from itself for itself. They have it because industry is life's great battlefield. By harmonising the game as a whole, they can bring about that spirit of co-operation which alone will enable this old country to free itself from the millstone that the war has fastened round its neck.

In the words of an American writer, Charles M. Horton, "Industry is a clash." It always has been. But above the clash of machinery, the clattering of tools, and the shrieking of belts, there is to-day the fiercer clash of human wills that are out of pitch.

Common
view-
points.

Lack of harmony is the seat of all our troubles. Let us illustrate it in a diagram (Fig. 1).

At **A** is the bone of contention—the question at issue—the matter for decision. At **B** and

COMMON VIEWPOINTS

B and C are the two disputants, the contending parties, the opposite camps. Both see "knuckle ends." If some fog (D), physical or mental, prevents each from clearly visualising the other's knuckle-end, B and C will disagree as to details. If feeling marks their disputations, we have all the elements of a row.

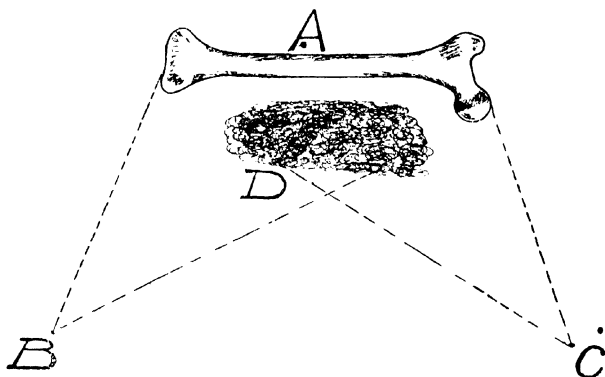


FIG. 1.

Why? Simply because B and C have a different viewpoint and feel strongly on the matter.

Just stop a moment. Look hard at the diagram. Get it firmly on your brain screen. It illustrates the source of trouble the world over—the germination-point of the toxin that poisons mind against mind, nation against nation, that sets sect against sect, labour

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against capital. Ignorance, blind, primitive ignorance, backed by prejudice.

Look again. It also shows how to prepare the anti-toxin that will at least prevent decent-

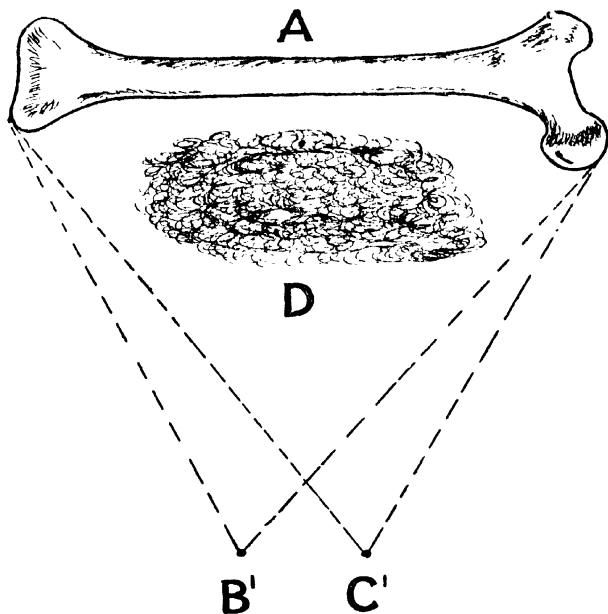


FIG. 2.

minded men from flying at each other's throats when they cannot see eye to eye. • If we are parties to a dispute we must get together, the Bs to B', Cs to C' (Fig. 2).

We must both set ourselves the task of

MUTUALLY HELD IDEALS

varying the angles from which we have hitherto viewed our common problems. Disputatious knuckle-ends must be sympathetically compared from approximately common viewpoints. We must educate each other or get a third party to educate us both. That is the root principle of the Joint Industrial Councils now coming into existence.

Never mind how platitudinous all this may sound. Turn it over in your mind to-day, to-morrow, and the next day. Make it the subject of discussion with your friends—and your enemies, if you have any. But, above all, see that you get a vivid mind-picture of the diagrams and their purpose.

Their great lesson is as old as civilisation. At the same time it is one of the underlying characteristics of scientific management and efficiency principles—the striving for a common ideal. I want to urge upon you with all the suggestive influence I can exert that it will more and more be recognised as the rock foundation of successful organisation. Mixed objectives and passion make organisation difficult.

Further, I have deliberately emphasised it here at the very beginning of our joint deliberations because I want you, reader, consciously—not tacitly or subconsciously, but knowingly

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and consciously—to try and vary your customary angle of viewing industrial problems. If you disagree with me and some of my views—and you inevitably must, since our experiences have not been the same—try and see my present viewpoint.

The need
for open-
minded-
ness.

Remember my view is not necessarily right—nor yet yours! As we go through life, various circumstances cause us to modify our opinions and creeds—ay, even the very sectarian creeds of our youth. As experience broadens, we learn that many wise-sounding epigrams and smug little phrases are half-truths. That on them false issues have been raised. That the half-lie part of them has repeatedly caused effete and even dishonourable practices to be retained. Or to quote a statement of Matthew Arnold's that might have been written yesterday: "The world is in torment for the want of living thought about its present affairs." It is the groping for this thought that has brought you and me together. Elsewhere on similar intent it is bringing hundreds and thousands of others together.

Though we seldom voice the fact, our consciences, if they are active, tell us that somehow or other we personally are not without blame for the recent world cataclysm. There is no blinking the fact that you and I, however

CO-ORDINATED EFFORTS

successful or efficient we may have been as individuals, have fallen short as citizens. And the result? Our united civic apathy has reacted on our joint industrial activities.

Technical and material progress has been advanced, but corresponding social development, the advancement of co-ordinate effort, has been neglected. Yes, you and I are to blame. For my part, I confess I have been so engrossed in my work, reading and other occupations, that until this last election I had not exercised my parliamentary vote. Until recently I did little towards getting a right perspective on the Labour-Capital grouch or the pettifogging, stultifying sectarian squabbles that are a disgrace to our generation. Only recently have I had the courage to raise my voice in protest against the vicious inefficiency of our educational methods. In short, I had been content to remain in blissful ignorance of the teachings of sociology.

What has this to do with organisation, past or future, or the functions of managers, foremen, and workers? Just this. No one who aspires to be an efficient manager or a successful foreman can long remain ignorant of the fact that his main concern is men, and the main reason for their discontent is unsatisfactory environment.

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The primary function of a manager is the regulation and co-ordination of other people's activities. The primary function of a foreman is supervision and teaching. The great handicaps of both are lack of knowledge and poor imagination! Ignorance! Not knowing how! Lethargy in asking, Why?

How is this handicap to be met? Only by the policy of an *ever open mind and clearly defined aims*. That must be our slogan. It is the teaching of our diagrams. It is the substance of the gospel of good tidings industrially, for which we owe so much to our American cousins.

American
writers.

No one who has taken the trouble to acquaint himself with the development of industrial literature during the last dozen years or so, can help recognising the superiority of American contributions over British. From the days of F. W. Taylor, the pioneer of modern Scientific Management, a steadily increasing band of bright intellects has made the world their debtors by the readiness with which they have published the results of their investigations and deliberations; until the United States to-day can claim to have blazed a new trail for industrial organisation. To name but a few of their leading lights other than Taylor, we have had

AMERICAN WRITERS

the Gilbreths, husband and wife, with their excellent works on *Motion Study* and *Industrial Fatigue*; Harrington Emerson with his lucid treatment of *Efficiency Principles*; Elbert Hubbard on *Business Philosophy*; A. L. Gantt on *Work, Wages, and Profits*; C. B. Going, A. H. Church, Benj. A. Franklin, Prof. E. D. Jones, Prof. Dill Scott, St. Elmo Lewis.

These and a goodly company of others have done much to broaden industrial outlooks, to dispel the miasmas that only too frequently enfog the average man in industry and to educate a vast army of capable subordinates. Only the other day I read that to the philosophy of Elbert Hubbard—a *Lusitania* victim by the way—was to be ascribed the fact that American shipbuilding got Charles Schwab at its head and obtained such results that it was a question whether Charlie Schwab was not getting more popular than Charlie Chaplin.

They have further created a new profession variously known as Industrial Engineers or Efficiency Experts, etc., who act as professional consultants to manufacturers, visiting their works and pointing out methods whereby production may be increased or waste prevented. In this connection it is interesting to note that the Parliamentary Committee

SCIENTIFIC FACTORY MANAGEMENT

on the Engineering Trades recently reported that "we look forward to the rise of some such class of adviser for the Engineering Trades," and significantly commented that "the exclusiveness of the English manufacturer has up to the present made such an official an impossibility."

We want them badly. Why? To help us scrap — and scrap quickly — the worn-out methods and appliances that do more to restrict output than any "ca' canny" on the part of disgruntled workers; to help to re-organise the factories of this country that we can pay higher wages on a lower labour cost per unit produced; to help us so conserve our native resources in men and materials that the war burden does not cripple us for years; to help us prepare for the intensive peace struggle that must follow the war struggle as sure as day follows night.

**The vital
game of
business.**

Alongside much that is excellent we have a vast archipelago of mean sordid factories that are a standing disgrace to Church, State, and the Public Conscience.

Too long has the Church resembled a band of Levites, deliberately passing by on the other side and ignoring the wounded victims manacled and shackled by daylight robbers. Too long has the State been grossly negligent in per-

BUSINESS ETHICS

mitting unqualified practitioners almost full liberty to supplement ignorance by nefarious practices.

Mark you, I am not contending that this indictment of business men is universally true. There have been and are many men who play the game of business as fairly as any man could wish. But the low standard of the others has given Labour much justification for its grouch against Capital. Because we have tolerated unbridled greed and inefficient managers, the vital game of business has been poisoned.

Yet business, with its special phases of industry and agriculture, is the life-blood of our national strength. It must be purged of impurities. Its underlying principles must be better understood; its ethics safeguarded. In its fundamental essentials business is simply human relations adjusted to a financial end—for the interchange and satisfying of wants. It is well organised only when its elements are brought into such relations as contribute efficiently to the one great aim of mutual advantage.

Industry, again, is essentially the application of motion to materials. Production changes their form. Distribution changes their place and ownership. From the social standpoint

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any motion not serving a useful purpose is economically wrong. So is the deliberate omission of useful motions. Both raise costs—Casson's seventh axiom of business (13).

Organisa-
tion,
efficiency,
and pre-
pared-
ness.

From every platform and in every newspaper is being preached the doctrine of Organisation, Efficiency, and Preparedness. The redemption of the nation's wealth, we are told, can only be accomplished by hard work *accurately directed*. People generally have been giving attention to their physical requirements, but have neglected the needs of the mind, and are unable to think out matters for themselves. For want of this ability they are at the beck and call of anybody who makes it his business to exploit them. In the proper training of the mind lies the secret of whatever success may be achieved in post-war activities (*Shoe Trade Journal*).

Isn't that good sense ? Isn't it right ?

Do you remember reading what W. M. Hughes, Premier of Australia, said in the Queen's Hall, London, last year ?

"Look at it from every point of view, national, imperial, individual, labour, capital, you are forced to this conclusion, that there is no way on earth by which you can bear the burdens imposed by the war, hold your own as a great economic power, deal effectively

WORLD MOVEMENT

with the great economic question, provide employment for your returned soldiers—in short, deal with all phases of the question—except by resort to such means as will enable each individual unit to produce very much more than before the war.

“It can be done by organisation—of that I am convinced—but in no other way. That the world will organise—that it will be forced to organise for economic purposes—that it is organising—is certain.

“Germany is perfecting her organisation. . . .

“What are we doing? . . .

“There must be organisation throughout the whole economic sphere, there must be co-ordination amongst its infinitely complex and delicate parts. . . .”

And did you see the letter of comment on this speech written by a British soldier in the trenches? It certainly impressed me. While the guns were blazing the way to victory, those at home were to turn their thoughts and fill their hours with three supreme imperatives—Prepare, Organise, Co-ordinate: to cut new channels for the tributaries of business; to organise for efficiency, for efficiency would rule the world and commerce.

“All right,” I can imagine you saying, “I

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**Human
vehicles.**

admit we have to be prepared. But what's wrong with us ? " As a nation, what's wrong with us ? We've fatty degeneration and a bad circulation. Oh ! I expect an Army doctor would pass us all right. It's not our hearts. It's our heads. I know that's what is commonly called insulting. But isn't it a fact ? As a race, we English are mentally easy !

Most of us left school a score or more years ago, and have since neglected to exercise our brain muscles regularly. How did you yourself qualify for your present position ? To-day it is no earthly use being content to step into dead or discharged men's shoes and follow their rule of thumb methods.

How many present-day foremen have studied foremanship ? How many managers ever worry to find out how men in other trades manage and the principles underlying their methods ?

How many manufacturers or their foremen have studied modern organisation like a doctor or a lawyer studies his profession ? No wonder we have many sleepy old towns with relatively few highly efficient factories. How do I know that ? Why, if there were, most of the present big factories would be nearly out of business, and there would not be so many small factories. Small factories on staples only prosper because of the defects of the big factories.

HUMAN VEHICLES

And whilst I am on this point—which I know is a very sensitive one to most Britishers—do you realise it is a general fact that the larger the business in any industry, the better it is for the public—not excluding the workers? Take one example: The enormous Armour meat business in 1916 netted only 3 per cent. profit on sales. Is there a small butcher anywhere who can do business on so small a profit and live. It is true they have not since been content with so small a profit.

Or take another example from the shoe industry. Official figures for last May show that on the average the American shoe factory apparently employs nearly six times as many people as the English factory, and that the American operator gets twice as large a weekly wage. Yet the American shoe can compete in price with the English shoe!

If my medicine has begun to act, let me suggest, reader, that in the national interests you and your friends take to reading tip-top books on industrial organisation. Remember how in a medical prescription some of the ingredients are included merely to act as vehicles for the principal ingredient. You and I are the vehicles by which our country's industry can be put on a better basis. Let us function as efficient vehicles.

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Organisa-
tion indis-
pensable
to
growth.

What books do I suggest? First of all Harrington Emerson's *Twelve Principles of Efficiency*, especially the first two chapters (1).¹ Secondly, any of the Gilbreth books, but more especially perhaps their *Applied Motion Study* (30). Or, if you want a small introductory book, you won't go far wrong with McKillop's *Efficiency Methods* (19), a recently published book. But see list, Appendix I.

You will then, I am confident, recognise more fully the truth of Herbert Spencer's statement, written in 1873 (*Study of Sociology*, p. 65) (37): "Socially, as well as individually, organisation is indispensable to growth: beyond a certain point there cannot be further growth without further organisation." It is often a painful process and one involving the scrapping of quite usable equipment and appliances. But it is inevitable at times!

What made Prussia, formerly a small, poor, second-rate power, a dominant figure in world politics? History tells us that it was the adoption by Bismarck, the ruthless statesman, and Von Moltke, the organiser and general, of an organisation capable of attaining and maintaining their ideals, and the selection of competent and forceful leaders trained to provide and supervise the requisite equipment.

¹ Numbers in parentheses refer to books in Appendix I.

BETTER ORGANISATION

Those two men planned and organised on a scale undreamt of by less progressive leaders. With the rightness or wrongness of their ideals we are not now concerned. But from their methods we can learn much. If any one wants an inspiration therefrom, I suggest he studies Emerson's first chapter (1).

But just one plea for indulgence, reader, in case any opening expression of mine should have hurt your susceptibilities. It is difficult to advocate certain principles forcibly without individuals, unable to free themselves from the personal point of view, immediately jumping to the conclusion that poisoned attack is being made on their personal competency and skill or that their whole class is being unjustifiably criticised. My appeal is for better and more scientific organisation.

For Greek athletes could have made good records if they had had bicycles, motor cars and aeroplanes, repeating pistols and rifles. The primitive savage, equipped with a rifle, is far more powerful than an armoured knight of chivalry.

Similarly, the mediocre manager, strengthened by a modern organisation, is much more effective than the greatest industrial genius working on early Victorian lines. What could not

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British industry do, if it organised according to the best ideas of the day !

So let us be sensible and not get at cross purposes. The one sure way to beat Germany or any other competitor at peace problems is to learn how to work better, quicker, easier, and more efficiently than Germany or he does.

We may talk about boycotts and tariffs, Leagues of Nations and Government subsidies ! None of these things ever made a nation rich and never will.

If you are a runner and you want to win a foot race, the only way to win it is to run faster than the other man.

THERE IS NO SUBSTITUTE FOR EFFICIENCY ; and nothing but efficiency—more and more efficiency—will put us at the front in the markets of the world (*Efficiency Magazine*).

Short
cuts and
efficiency.

Efficiency is the shibboleth of to-day—Efficiency with a capital E. To be efficient means taking the shortest cuts to the desirable things of life, to get maximum results with minimum efforts. The best, easiest, and quickest way is the right short cut. Just as there are short cuts to knowledge and training, there are short cuts to industrial efficiency ; and standards form one of the chief.

Now Science, the short cut to short cuts, is based on principles. Indeed, principles may

BASIS OF EFFICIENCY

be defined as short cuts to knowledge. And Emerson has shown how the science of Efficiency is based on thirteen main principles—six ethical and seven practical principles ((2) and p. 173). Three—that is, nearly half—of his practical principles are :

Standardised conditions.

Standardised operations.

Written standard practice instructions.

All three bulk largely in large scale organisation. One of the most important tasks in practical efficiency work is the shortening and simplification of the routing of materials, orders, requisitions, reports, invoices, or other papers through factory and office. This, clearly, is a matter, partly of standardised conditions and operations, and partly of written standard practice instructions, planning, and despatching. Unfortunately, many British factories are still so small or so primitive in their organisation that they don't even favour such "bureaucratic fads" as written requisitions and reports passing through the factory. They don't want "red tape" !

Oh ! I know I ought not to be ironical or so blunt of speech. But these are surely days when some of us must rush in where angels fear to tread, and having the courage of our

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convictions voice our criticisms in the interests of the community.

To return to the question of standards.

Every thinking man who picks up the Annual Reports of the United States Bureau of Standards must see the fore-shadowing of big possibilities for the future, especially when he reads the self-imposed definition of its functions :

The development, construction, custody, and maintenance of Reference and Working

STANDARDS

and their intercomparison, improvement, and application in science, engineering, industry, and commerce. (See Appendix III.)

Standards and their rôle.

A standard is something established by investigation and authority as a reasonable attainment of desirability. Few factories anywhere are rarely so favourably situated that they can afford to set up standards for the whole industry. Nor have they the requisite authority. Nor at present are manufacturers' federations sufficiently organised to carry this work far, while it is hardly to be expected that the operatives' unions can devote any large portion of their funds to the purpose—though their members would most certainly

NATURE OF STANDARDS

benefit thereby. However, without precise standards, efficiency and high wages are impossible in any competitive industry. So both manufacturers and operatives' associations should of set purpose play their part in developing national standards.

If we look at the general question a little more closely, we shall find

(a) Every standard has several factors, *e.g.* supply or quantity, use or time and speed, quality or price, assignment or economy, etc.

(b) Standardised conditions make work easier and quicker, set healthy alert minds free for further standardisation and accelerate the progress of efficiency.

(c) Standardised operations replace guess-work by accurate knowledge, reduce effort, and increase results, but often require years of investigation and the breaking away from tradition before they can be firmly established.

(d) Written standard practice instructions bring down to us in definite, concise, and practical form the results of study, thought, experience, and observation on the part of others; moreover, they crystallise and make practical the results of individual thought, study, experience, and observation (2). •

Admittedly, no single person, factory, or industry can achieve any substantial result

SCIENTIFIC FACTORY MANAGEMENT

without a certain degree of standardisation, often unconscious; and each has already achieved something in the direction of concrete standards. But the demands made upon our generation are greater than those made upon our fathers. And we have no more time or energy than they. Therefore to meet the increased demands we must take short cuts and avoid repeatedly solving the same problems over and over again. In other words, we must systematically set up definite industrial standards. Some will be fixed, while others will be constantly changing according to conditions. Some will be appropriate to particular people and plants, and others to the whole industry.

After all, why should not each industry have its own Standards Association like the engineers, and from time to time issue approved definitions and specifications? It would clear the air of much needless controversy and ill-founded contention. It would push the industry a long way forward to the policy of the future, namely, first national and then international trade standards. It would facilitate increased production; promote large scale and cheaper manufacture; enable the State, capitalist, and worker to derive greater industrial benefits from the activities of the great

TYPES OF ORGANISATION

staple industries ; and automatically prevent much hardly-won and valuable experience lapsing in future with the death of individuals and requiring a laborious rediscovery by their successors.

Standards, then, are at the same time both short cuts to industrial efficiency and the bricks of future organisation. So why not standards of organisation?

Of organisation Emerson suggests there are two main types. In the second chapter of *The Twelve Principles of Efficiency*, he discusses their difference in spirit and effectiveness. The common form of organisation he designates the wolf-pack or offensive-destructive type, and the future better type he terms the rose-bush or defensive-upbuilding type. Types of
organisa-
tion.

In the former, some strong male, man, wolf, or baboon, who has worked his way to the top, is given allegiance, based partly on fear and partly on self-interest. He in turn either delegates power, or each lower rank of his followers usurps power ; and this results in some form of anarchy all down the line. Consequently the organisation is built on the principle of individual arbitrariness at the top.

The second type, on the other hand, imitates the rose-bush in relying on allies outside itself, *e.g.*, the bee for fertilisation. Various functions

SCIENTIFIC FACTORY MANAGEMENT

are placed in the hands of staff officials, whose duty it is to serve the men below them. The foreman is not there to relieve the superintendent of responsibility, but to supervise and teach the workers ; the general manager is there for the sake of the superintendents, etc. etc.

The wolf-
ack
type.

The first type, then, dates back to the time when might was right and moral concepts subservient to muscular force. The theory of all such organisation is that authority, responsibility, knowledge, wisdom, and judgment reside primarily in the chief executive, and that all subordinates take their orders either directly from him or through sub-executives under him.

In a pure type of this kind of organisation each department would keep its own accounts : each foreman do his own purchasing and marketing of his product, look after or neglect the sanitation, heating, and lighting arrangements and other conditions of his department, etc., and each worker settle his own way of going about his work.

It assumes that the workman knows the best method for getting the results demanded of him ; that each foreman knows how and where to find the best man for each position under his supervision, and how best to handle him :

THE FUTURE TYPE

that each superintendent knows how best to organise the machinery of his department, how best to plan, schedule, and despatch work for which he is responsible.

We find, however, that most businesses have glimpsed something of the folly of this extreme type, in that purchasing, accounting, costing, inspection, finance, and other specialised departments have been widely established. It is true they are generally under the same arbitrary rule, but they mark a distinct step towards the second type of organisation.

In the second type the ideal is not to sustain arbitrary authority, but to accomplish the purposes of the organisation by a process of expert co-operation.

Instead of the worker being left to choose his own tools or to use the methods that his untrained judgment suggests, he is supplied with tools and taught methods shown by scientific methods to be most efficient.

Instead of the foreman being permitted to use his own biased and possibly ignorant methods of employment, discipline and shop management, he is supplied with scientifically selected help and assisted in methods of discipline and management, carefully worked out by experts.

The superintendents are similarly guided

SCIENTIFIC FACTORY MANAGEMENT

in their choice and arrangement of equipment, assisted in the formulation of plans, and helped in the writing of schedules by staffs especially trained for that work (p. 193).

According to the size and character of the business we find experts in lighting, heating, sanitation, etc., keeping of stores, costs, selling, buying, paying, and fixing of rates, etc. Records are devised and kept, plans, schedules, and despatching directed, standard conditions determined, etc., competent counsel sought and given, and efficiency rewards calculated by specialists who form an integral part of the organisation (24).

Every organisation is essentially a theory of corporate activities, a working ideal which in practice may be complete only on paper. To make it effective it must be well administered. Administration is the managing of an organisation, a feature distinct from managing the work which the organisation has to perform.

Taylor's
shop
organisa-
tion.

If we now study a chart showing Taylor's functional foremen (p. 79), we shall see how early scientific management endeavoured to arrange for the foremen to act more as a worker's guide, philosopher, and friend than as his judge, jury, and lord high executioner. Functional foremen differ from the usual type of foremen in that the latter have full charge

ITS LEADING PRINCIPLE

of a certain number of men, while the former have charge of a certain function.

The leading principle is briefly that one lot of men determine the standards to which another lot must work and by which another lot compare the finished product, technically by inspection and quantitatively by costing; but all the functional foremen must be prepared constantly to teach and help the individual workmen with whom they are brought into direct contact.

Or, in other words, Scientific Management aims at management by measurement. Its fundamental principles have the exactness of scientific laws and are open to study by every one. Its skilful application is an art and must be acquired. It is not yet an exact science, though it is well on the way.

Thanks to the breadth of view of its great pioneers, there is nothing hidden or secret about it like the working practices of an old-time craft. Its fundamental aim is the elimination of waste—waste materials, waste motion, and the attainment of worth-while results, with a minimum of time and effort.

Its methods are, in short, those of the scientist, and the question arises: In what way do they differ from those of the average industrialist?

SCIENTIFIC FACTORY MANAGEMENT

The
scientific
method.

All science rests on a limited but constantly increasing body of facts, often laboriously collected and classified. Classification, again, is followed by generalisations into accepted principles or laws, and further generalizations into those comprehensive hypotheses or theories that bind the known facts together. The scientist is, however, essentially an intellectually honest man. Until his theory has been tested and verified, it is frankly and admittedly a speculative guess. So inquiry is continuous; or, science is continuously reviewing its facts and theories in a constant effort to make them harmonise: for the scientific mind recognises the constant possibility of error being concealed in accepted truths (16).

In his description of the scientific method, Prof. E. Ray Lankester thus defines the place and function of theory :—

First, accuracy in the observation and statement of a fact.

Secondly, the formation of often far-reaching guesses in explanation of the fact suggested by a knowledge of other well-ascertained facts.

Thirdly, the guess being then tested and so either established or discarded by means of experiment or by further observation or by logical inference of ascertained facts.

THE SCIENTIFIC METHOD

Or, in the more homely language of the authors of *W. E. Ford* (56), the truly scientific mind first marshals and arranges the available facts without partiality ; secondly, insists on looking at the facts to discover a principle ; and, thirdly, struggles for a right application of the principle.

Again, taught by centuries of painful striving, science has learnt that it cannot be too careful about accurate definitions and, where possible, exact measurement of its facts. Facts are the brickwork of its laws and established theories. These latter are more than the sum total of the known facts—they signpost the road to fresh discoveries and new fields of activity.

Science has, in short, raised itself to the forefront of accepted knowledge. And it has done this against the stubborn prejudices of Church, State, and popular predilections. How ? By ruthless analysis and unbiassed observation. To-day it is counselling commerce and industry : “ Make sure of your facts : Agree upon the precise significance of your general terms : Argue your deductions frankly and dispassionately. Examine your old beliefs.” All scientific investigation is, at bottom, the seeking of points of agreement and points of difference (pp. 41, 163, 177).

SCIENTIFIC FACTORY MANAGEMENT

Now this discipline of facts and their proper connection is the very essence of efficiency. The big captains of industry become big because they recognise that facts and laws—to find which they spend millions of money—are bigger than themselves and to be obeyed. They run their businesses like a railway runs its trains—on a time-table of facts.

The giants of business discipline their minds to review facts dispassionately however unpleasant, because they realise the simple human verity that no man can ever know everything about anything. They follow the lead of the scientist in that they continually examine the grounds of their convictions, prejudices, and beliefs.

Why, then, cannot we of baser clay make Scientific Factory Management a British ideal, develop it as a science, and house it with the architectural taste that marks the home of the Dexter rainproofs at Cathcart, Glasgow? (See also Kahn's *Industrial Buildings*, etc.)

Lessons
from the
big
business.

Now, reader, don't tell me this sort of thing is only suitable for a big concern and therefore does not fit a little business like yours. Christian Girl, the President of the Standard Parts Company—a company that started with \$100 capital, and within eleven years built up a business with a net worth of \$35,000,000—

BIG BUSINESS

recently asserted that "The fellow who has a little business calls himself a little business man. He wants to know only about other small business men and dismisses the lessons from larger affairs, believing they are of no value to him. This type of mind is doomed to remain small. Yet if he gets nothing more than a new viewpoint from studying the methods of big businesses, his effort is well spent."

Occasional indulgence in a philosophic contemplation of big subjects enlarges our conceptions of things possible and enriches our intellectual imagination. But what we get out of it depends to a very large extent on our ability to adapt ideas. Most of us will, for instance, have heard in what strange guises and forms men have got new sales ideas. The president of a big American motor-car company adapted plans he had used in his early experience in selling coal. One of the most successful ideas used in selling Ford cars, we have been told, was a re-varnished plan used years ago by the salesman when he sold life insurance. Or again, the sales plan for keeping the rooms of a well-known hotel filled was lifted bodily from the experience of a plumbing supply house.

As Carlyle said, that man is most original

SCIENTIFIC FACTORY MANAGEMENT

who is able to adapt from the greatest number of sources.

SUMMARY

Or, summarising, we may conclude :

1. That we must constantly challenge our old industrial beliefs.
2. That we must strive for common viewpoints with our fellow-workers.
3. That the tendency of industry is to be captained by considerate efficiency and to depose arbitrary authority.
4. That we must organise for co-operative action by specialists.
5. That we must collect, classify, combine and challenge our industrial data.
6. That scientifically determined standards will be the brick-work of future industry.
7. That we must collectively strive for the development of organisation along scientific lines.

CHAPTER II

^cTHE FUNCTIONS OF MANAGERS

A MANAGER'S main ideal should be to so train his thought processes that he can the more readily see what activities he should discontinue and which he should add—with, of course, due regard to group effectiveness.

To be a successful administrator he must be able to visualise his institution and the positions in which human beings are required to make that institution a service-rendering machine. He should read human nature like a printed page and study his helpers as a chemist studies his chemicals.

For he is primarily the regulator and co-ordinator of other people's activities, and not a technician changing the form of materials (p. 165). To that end he must train his own senses so that he can see right, smell right, feel right, and taste right—or, in a word, judge right—like a dispassionate, unprejudiced scientist.

It is precisely this co-ordination, or what

SCIENTIFIC FACTORY MANAGEMENT

Field-Marshal Lord Haig in one of his despatches termed "cohesive control," that is a manager's most difficult task.

We all know how much easier it is at times to do a job oneself instead of getting others to do it. They have not our viewpoint nor yet our particular experience.

One-man
manage-
ment.

Everybody who has had any experience of committee work knows that the most effective committee for a short job is the committee of one. Why? Because the co-ordination of activities is virtually automatic. It takes place subconsciously under the one "bonnet." There is no need to argue or, what is more difficult, to explain. There is no need to hold conferences or to commit ideas to paper. Indeed, it is not always necessary to have ideas that can be clearly expressed. Single bonnet co-ordination is frequently very effective when subconscious ideas are surprisingly indefinite.

The small business has similar compensations in that it is usually compact and its operations can be kept under the personal supervision of the manager. And since co-ordination is relatively easy, he can readily act as sales manager, factory superintendent, or purchasing agent as necessity demands.

As A. W. Shaw, the Harvard lecturer on Business Policy, well expresses it (66), the man

“ONE MAN” BUSINESS

at the head of a small plant has need only of a personal system or routine which brings him into frequent contact with all his workmen and all the jobs they are engaged on. If he has a real knowledge of the technical processes and a certain amount of personality—the typical “one man” business seems to be built largely on these two elements—he can at the same time control the quality and cost of output, hasten production and accommodate it to sales or financial exigencies to a degree that few large businesses can hope to equal. But when he finds it necessary to delegate authority because important details have so multiplied that he can no longer handle all of them, a more formal organisation becomes essential if his plant is not to lose efficiency.

Or, in the words of Alfred Marshall, the crucial point in business expansion arrives when orders must be written instead of spoken. To keep operations under control while delegating supervision and authority is the manager's broad problem in organisation! When the growth or size of an undertaking forces him to substitute organisation for personal supervision, it is in the factory that he finds it easiest and most profitable to share his functions and responsibilities with subordinates. It is there individuals have had most experi-

SCIENTIFIC FACTORY MANAGEMENT

ence in handling large bodies of men banded together in industrial groups.

Types of
manage-
ment.

When he examines the practice of other manufacturers, he finds he can divide all management into three main types, viz. :

1. Traditional, sometimes styled "old military," "line," "driver," "conventional," or "initiative and incentive" (F. W. Taylor).
2. Transitional, sometimes styled "new military," "line-and-staff," "systematic."
3. Scientific, sometimes styled "functional," "measured functional," or "ultimate" (L. M. Gilbreth).

Under the first, until our own generation the only common type, the laws or principles underlying right management are usually unknown and hence often disregarded. Men follow traditional rule-of-thumb practices. The head of each department or sub-department is held responsible for all that happens within his jurisdiction and is almost a law unto himself.

In the second, the laws are fairly well known and fairly well observed as soon as functional foremen or specialists can be taught their new duties and the resistances of human nature are overcome (3). The old line organisation is kept to supervise operation, while a staff of specialists is added to analyse materials,

TYPES OF MANAGEMENT

machines, methods, routing, and other factors in production, to determine standards for each and to secure the adoption of those standards by the regular line organisation.

In the third stage, we have management by measurable standards, and according to formulated and applied laws (7), or the application to management of the principle known as the division of labour. According to L. M. Gilbreth, its underlying ideas can be grouped under some nine divisions, viz. Individuality, Functionalisation, Measurement, Analysis and Synthesis, Standardisation, Records and Programmes, Teaching, Incentives, Welfare. Each of these is made the subject of an informative and interesting chapter (32).

To the business man approaching the subject of scientific management from the outside, the apparent amount of new clerical and general preparatory work seems frightfully costly. Often, of course, such management unabridged may be beyond the present scale or needs of his business. But the principle behind both it and line-and-staff management—the finding and using of the “one best way” of doing things under present conditions—cannot be ignored if his business is to grow and meet competition founded on this fundamental of efficiency.

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Defects
of the
traditional
type.

Just as there are two sides to every question, there are both advantages and disadvantages in the traditional or ordinary line type of management and its organisation. It unifies work by concentrating authority and holding the head of the department solely responsible for results. As M. Ward pointed out in *The Organiser* (Sept. 1918): The supporters of the departmental (*i.e.* line) system claim that it avoids the excessive amount of form work and expensive detail incumbent on those who adopt the strictly functional organisation. Or its inherent strength lies in the automatic co-ordination under the single bonnet.

As the shop or factory grows ever larger, however, the manager must necessarily leave more and more to the foremen, and they in turn more and more to the sub-foremen, and so on right down the whole hierarchy. Consistent and comprehensive records, except perhaps of cash at bank, are seldom forthcoming when wanted.

The demands upon the foreman's time and skill, on his intelligence and patience, increase to a point where it is difficult to satisfy them. He may slog like a Trojan. But he is only human, with very definite limitations, both mental and physical.

Unless the size of his department or the

EFFECT OF FACTORY GROWTH

character of its work allows him to master technical details and oversee all the processes for which he is held responsible, the efficiency of the individual workman and of the factory as a whole must perforce suffer.

Consequently it does not require much logic or argument to show that in large departments an economic application of "line" organisation is only possible where the machinery is mainly automatic and the processes virtually standard and continuous—where, in fact, there are no extraordinary demands upon the foreman's initiative, and his duties include little beyond keeping the men at work, maintaining discipline and seeing that work in progress moves according to schedules.

But where teaching of workers, selection of specially skilled men, close measurement, careful planning, etc., are wanted—what then?

What do we find in every large-sized department in the assembling industries? Just this, that they have been invariably driven on to some one or other modification of the functional or line-and-staff type.

Under traditional management, when the "something wrong somewhere" cry goes out, your foreman more often than not speeds up his men; he drives them to the limit of their

SCIENTIFIC FACTORY MANAGEMENT

undirected efforts, regardless of their welfare. Success or failure is seldom studied and measured, so that causes may be well understood. Few analyses are made that are of permanent value. Records are mainly conspicuous by their absence. Nearly every investigator of troubles begins at the beginning. The resultant waste of time and effort is appalling.

Analysis
and syn-
thesis.

In short, under Traditional Management conscious analysis and synthesis are seldom present, or, if present, are usually unsystematic and haphazard. Analysis is the taking to pieces of complex processes so that their several constituents may be separately examined and inspected. Synthesis is the rebuilding of the constituents back to the original—for purposes of comparison and the establishment of standards.

Under Scientific Management, when the elements, whether of individual action or output of any kind, have been measured, synthesis re-combines them into the most efficient whole. The result is used until a more accurate or efficient standard replaces it. By analysis and synthesis, quantity of output can be predicted and quality of output be assured.

Pick up any scientific text-book ; or, study any science. What do we find ? That an-

ANALYSIS AND SYNTHESIS

alysis and synthesis have played an enormous part in its development. Research workers are continually hammering out fresh principles and discovering fresh laws, upon which each succeeding generation of workers will continue to build. Fully half their ambition in life is to further their particular science.

What has been the result? An advance that has put the scientist in the forefront of civilisation. His attitude of mind is more suited to the times than is that of the average factory manager. Yet it should not be so. He is primarily a member of a supplementary or facilitating social service—not of the more fundamental or national producing service. His example must be studied, copied, and improved upon by industrialists as a class.

Successful industrial management is the biggest single factor in our country's immediate future. There must be keener and closer examination of its responsibilities, keener and closer analysis of its operations, and a greater readiness to communicate these results to collating authorities—whether these be a progressive academic body like the Harvard School of Business Practice or a wideawake States bureau, a trade federation, or a joint industrial council. Both outside and inside the factory there must be more conscious

SCIENTIFIC FACTORY MANAGEMENT

and deliberate analysis, with its consequent synthesis.

Antiquated forms of management are holding back British industry. Nor can we be greatly surprised. There are relatively few managers who have studied management in any other school than the University of Hard Knocks, and that is an extortionately wasteful institution (55). We in industry to-day should see to it that the country is provided with well-equipped training centres for our successors, that they are well trained, and that the problems of industrial management are closely analysed and synthesised.

Everything that happens in this world is in the last analysis explicable. Because business men generally have not recognised this fact, so many of them have been as shackled prisoners moving along the highway of commerce. They have been in too much of a hurry, so they say, to stop and think.

Management becoming a profession.

Business is, however, fast becoming more and more a congeries of professions (67), the greatest of which will prove to be management. As Prof. Sidney Webb emphasises in a little book that should find a place on every manager's bookshelf (8), the modern manager belongs to a brain-working profession, just as much as the lawyer or the doctor, the accountant

MANAGERIAL TECHNIQUE

or the engineer. His function is not primarily that of a buyer of materials, a seller of goods, or an inventor of processes. It is "the quite distinct profession of organising men—of so arranging and directing the activities of a band of producers, including both brain-workers and manual workers, as to create among them the most effective co-operation of their energies in achieving the common purpose."

What the manager has to handle principally is not wood or metal, but human nature; not machinery, but will. Consequently, he must have something more important than a profound acquaintance with the technique of industrial processes. He must be proficient in the technique of handling human nature in conjunction with machinery and materials. And the larger the concern, the more important is this managerial technique (p. 164).

Again, how misleading are those terms, brain-worker and manual worker! The miner traces his seam and directs his pick with his brains; the fitter adjusts and measures under the guidance of his brain. Actually there is no task that does not in some degree call for brain action, direct or indirect. Similarly, there is no productive brain work that does not call for some form of handwork. In short,

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the brain is the directing power of all bodily activity, whether breaking stones or solving problems. But in the present state of society, high mental efficiency is scarcer than high manual efficiency, and therefore commands the higher remuneration.

Of one thing we can be quite certain, whatever the future social order may be. With the ever-increasing complication of industry, the profession of industrial manager is destined to develop a steadily increasing technique and a more and more specialised vocational training of its own; and ultimately, perhaps, to run an Institute of Managers charged with the progressive development of their common profession.

Until recently it was assumed that management was an art, if not actually a divinely bestowed gift; or, at any rate, that it could only be learnt by watching other managers. But with the advent of Scientific Management and its demonstration that the best management is founded on determinable laws, the study of management has become possible apart from the actual job itself.

Deter-
minative
and ad-
ministra-
tive man-
agement.

According to A. H. Church (9), management has two main elements—Determinative and Administrative. The former, reserved by the board of directors, decides questions of broad

TWO MAIN ELEMENTS

policy, and its tendencies are steadily narrowing down towards financial and away from manufacturing considerations. The latter, devolved on a managing director or general manager, sees that the determinative policy is carried out and co-ordinates consequent routine activities.

These two elements, combined in small businesses, have to be separated if large organisations are to be successful. The determinative element demands the scarcer faculty, and exacts a high standard of judgment, foresight, courage, and the experience necessary to decide large points of policy. Errors are of less importance in the administrative element. Their results can be more quickly reduced to safe proportions, since the assistance of all kinds of experts can be obtained. Competent counsel can be most readily consulted.

Though the determinative element has not as yet been reduced to a body of principles, or even working rules, the administrative element has been much more closely studied of late years, especially in America.

Broadly speaking, its problems are three-fold :

- (a) Productive or manufacturing ;
- (b) Facilitative or intermediary ;
- (c) Distributive or selling ;

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all intimately bound up with the subject of organisation.

Five
manufac-
turing
functions.

Philosophical analysis, working on the analogy of the human body, has led to the view that administrative management is essentially an organic affair. In the modification of an Emerson saying, put forward by M. Bruce-Williams as the axiom of his science of organisation: "All society is an extension of the individual." Every industrial undertaking, then, contains groups of activities which, like the organs of the body, function independently, though in close co-ordination. There are, for instance, the five primary manufacturing functions which the owner of a growing business gradually devolves on subordinates.

In "the day of small things" a craftsman-proprietor exercises all the manufacturing functions in his own person. "Success" soon makes it necessary for him to devolve

OPERATION on apprentices working under journeymen, some of whom ultimately develop into foremen, and others into works managers and superintendents, according to the size of the business and their ability.

With the increased use of machinery 'it first becomes necessary to have a mechanic to attend to repairs, and then the owner gradually places

FIVE MANUFACTURING FUNCTIONS

EQUIPMENT in the charge of subordinates—repairs first; then power, lighting, heating, etc.; and lastly the entire control of plant and machinery.

With the further growth of the business, the owner begins to devolve the preparation of designs and drawings upon designers and draughtsmen, and to free himself from the function of

DESIGN, which, as a distinct function, soon has its own chief draughtsman, chemist, technical superintendent, or what not, and its own experimental and investigatory staff.

Up to this point most owners will generally have only approximated costs from rough memoranda compiled by themselves or their foremen, but gradually the work is devolved on to cost clerks and a costing section set up, primarily for the purposes of

COMPARISON, with subordinate pay clerks, time clerks, stores record clerks, etc., handling the accounting side of comparison; and, when the owner ceases to pass on completed work, with inspectors and ultimately a fully developed inspecting and testing department, dealing with the technical side of this function.

With still further growth, the owner finds it impossible personally to control and supervise the work of all his subordinates, and bit by bit deposes various

SCIENTIFIC FACTORY MANAGEMENT

CONTROL work to different subordinates, some of whom may deal with correspondence, purchasing, regulating the flow of work, or charting progress, and eventually specifying responsibilities and planning relations between departments.

When these five functions have been completely separated and organised, each again will have its own internal system of devolution to enable it sufficiently to fulfil its special purpose. For each, certain regulative principles are now becoming recognised and a standardised practice being slowly developed (9).

As the organisation becomes more and more complicated we find a still further development, in that the administrative management begins to organise groups of consultants, or consultative committees, whose expert knowledge is at the service of the "line" personnel, charged primarily with production and only incidentally with the improvement of product.

In other words, every progressive works has definitely to recognise a process of evolution and an "origin of species." Differences between factory organisations, in their developments are essentially of degree and detail but not of kind. Some, for instance, may have committees before they adopt functional organisation. Others, again, may have cost

GRADING OF PERSONNEL

keepers before they have a works engineer, or whatever the subordinates exercising the partially delegated functions may be termed.

To the five foregoing functions we have only to add the two "commercial" functions, Distribution and Finance, to get a fundamental analysis of a factory's corporate task. Charting the organisation.

Again, personnel responsibilities are similarly divisible. The three generally recognised grades are : Manager, foremen, and workers. Closer analysis will show :

GRADING.	PERSONNEL.	TASK.
1. Consultative.	Outside experts or internal committees.	Advisory.
2. Determinative.	Board of Directors.	General policy.
3. Administrative.	General Manager.	Group co-ordination.
4. Sub-administrative.	Functional Superintendents.	Detail co-ordination.
5. Executive.	Departmental foremen	Departmental supervision.
6. Sub-executive.	Sectional leaders.	Sectional details.
7. Operative.	Process workers.	Actual production.
8. Sub-operative.	Juniors.	Minor processes.

With the two great factors of industry, viz. people and task, analysed into natural and logical elements, we are in a position to construct a scientific framework for industrial administration.

At the apex of a triangle, we can place the

SCIENTIFIC FACTORY MANAGEMENT

administrative officer around whom the factory activities pivot. Dividing the base according to task functions, the sides and their extensions according to personnel gradings, and joining up as in diagram, we get a graphic framework, with which very few of us can

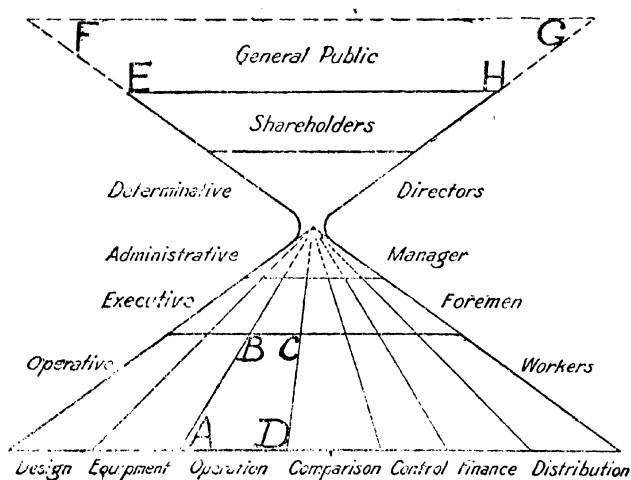


FIG. 3.

seriously quarrel. It helps us to a quick understanding of the organisation and its sub-divisions as a whole—and that is a useful step towards better appreciation of the parts.

It is, however, essentially diagrammatic and not proportional to relative importances, personnel numbers, or any special attribute—though “operation” has been purposely given

AN ORGANISATION FRAMEWORK

the largest area. According to Taylor's fourth regulative principle, the personnel in ABCD, viz. that which usually calls itself Labour, should do "half the work," whereas the practice of various prosperous concerns would seem to suggest ABCD employees numbering some eight to twelve times those in the rest of the triangle. Similarly, many people will doubtlessly consider the importance of EFGH overstated. But is it ? (pp. 180, 201).

Or, adopting for greater convenience the Mercator-like plan of a rectangle, with horizontals sub-divided by functions and verticals by personnel, we have the main elements of a Scientific Organisation Chart, into which we can insert designations and, if we choose, the names of the personnel (see Chart, Appendix IV.).

Here, then, is a sound key-plan for industrial organisation, something resembling an architect's plan. To my mind the adoption of an Organisation Chart outlining primary ideals is a first step towards reorganisation. It affords a sound working theory. Whilst a chart showing actual practice, however undeveloped, is a helpful guide at all times (p. 194).

Every middle-aged manager considering re-organisation plans and every student of Scientific Management would do well to read Auguste Comte's *Early Essays* (42), written

The
basic
problem
of
measure-
ments.

SCIENTIFIC FACTORY MANAGEMENT

in the early part of last century. They are particularly apposite reading for the difficult times through which we are passing. Comte regarded all departments of knowledge as component parts of one and the same great science — the Science of Humanity. He postulated three stages of knowledge : (1) the theological or fictitious ; (2) the metaphysical or abstract ; (3) the scientific or positive. His views on scientific operations are, to say the least for them, broadening and very stimulating to any student of modern industrial administration.

Nor need one have much acquaintance with scientific methods to realise how consistently the scientist endeavours to subject his deductions to physical measurement whenever possible (p. 28). Equally is it the endeavour of scientific management to measure outputs, methods, tools, and the workers themselves.

Systematic measurement enabled F. W. Taylor to solve his classic steel-cutting problems, to discover the laws relating to cutting metals, the laws for making high speed steel, laws for predicting maximum output a man can achieve and thrive on, law of percentage of rest for overcoming fatigue, laws for determining the selection of the men best suited for particular work, etc. Combined with motion study,

SYSTEMATIC MEASUREMENT

it enabled F. B. Gilbreth to cut down the bricklayer's work by two-thirds (29).

These two great pioneer instances form the opening chapters in the Romance of Modern Industry. They heralded in the efficiency expert and the stop-watch, to say nothing of the more elaborate instruments the Gilbreths now use. Exact measurement has in the past established exact sciences, and will in the comparatively near future establish an exact science of management, though in the very nature of things it must necessarily leave much scope for judgment and individual initiative in its practice—just as any other science does.

But I would sound one word of emphatic warning: Keep the stop-watch out of the hands of inexperienced or incompetent men without competent guidance! Properly handled, it is the workers' greatest friend, helping them to get a fair deal. Indeed, I look forward to the time when manufacturers and Trade Union leaders will unite to establish centres for determining methods of least waste by time and motion study, when Government departments will subsidise the publication of books containing time study tables (17, 30), when efficiency audits will be nearly as familiar as finance audits and measurable standards a regular feature of industry.

SCIENTIFIC FACTORY MANAGEMENT

Basis of
sound
mana-
gerial
judg-
ment.

Because we in this country have advanced so little beyond traditional management and the family proprietary stage, few factories keep adequate or sufficiently correlated records. On the other hand, many are kept that serve no useful purpose. We all know the arbitrarily started record that goes on month after month after its real purpose is served. Yet under all forms of management, the main results of records are the same if the records are correct and examined periodically. Output increases !

Records must be judged and their usefulness determined by the way in which they

- (a) reduce costs,
- (b) simplify work,
- (c) increase efficiency, or
- (d) facilitate management.

Records of efficiency may be of workers, of foremen, or of managers. They are the starting-point of all individual standards, and the subject-matter for future comparisons. Similarly, records of output, stock, purchases, sales, etc., serve to establish standards and afford material for subsequent comparisons. The larger the establishment, the more necessary it is to have immediate, reliable, accurate, and permanent records (1).

For quick comparisons, or comparisons over lengthy periods, graphic records are best :

BASIS OF JUDGMENT

they tell their story most readily and forcibly. W. C. Brinton tells us of a New York financier who had a graph room with a revolving chair in the centre, and daily studied his graphs of market fluctuations while he smoked a cigar (22). Again, visitors to the Ministry of Food will tell you with mystified awe about the charts that adorned the walls of a certain sectional Director's room. The mathematical engineer has led the way.

Industrial management has so far scarcely begun to use graph records. Yet a well-designed graph which presents just the essential facts is one of the most effective means a manager can have for showing where he can most advantageously focus his attention.

Right records establish facts. They afford the only sound basis of managerial judgment. That is the usual reason for their installation. But it should not be forgotten that they also have a very distinct psychological effect on the people whose work is recorded. Also, they afford the only sure means of preparing factory programmes and routing work. And when these are based on standardised elementary units they furnish almost dead true prophecies of what will take place. •

The war has made us so vary our manufacturing methods that as a nation we are at

SCIENTIFIC FACTORY MANAGEMENT

last beginning to realise the economies that flow from standardisation in production and distribution—although we have for some years had the Ingersoll and the Ford in our midst. However, on this point I cannot at the moment do more than say: “Read Casson on ‘Standardised Operations’ ” (12).

‘Facing
the
facts.

Read also his first chapter in the same book on “Replacing Opinions by Facts.” The Facts. No matter whether they are favourable or unfavourable, it is better to know the Facts. You may bluff an individual here and there, but you can’t bluff the whole structure of the business world. Therefore managers should deliberately set people on to ascertain the facts. No matter how busy or how prosperous a business is, it cannot to-day afford to live in a fool’s paradise.

The margin of safety is continually shrinking. Times change. Conditions change. Markets change. Competition changes. Methods change. So it behoves each of us to be ever facing the facts.

There is growing up a new body of industrial consultants, who are making an intensive study of principles. Every business of any size should periodically call one of them in.

We want no future Government Committees to bring such damning indictments against

FACING THE FACTS

British industrial management as those laid by Lord Balfour of Burleigh's Committee on the Commercial and Industrial Policy of this Country after the War (Cd. 9035). After reviewing British industry during the decade preceding the war, they concluded that the iron and steel trades had made comparatively little progress, and had come to be entirely over-shadowed by their great competitors in Germany and the United States. In the use and expansion of the more modern branches of industrial production, the United Kingdom had taken a very limited share, as was evidenced by our relative weakness in respect of the electrical, chemical, and chemico-metallurgical industries; they further added that in a number of smaller trades foreign manufacturers had shown greater enterprise and originality.

The man on the spot is apt to grow blind to things he sees every day, the junk heaps, the congestions that cause outputs to sag, the waste motions that run away with profits, the groaning shafting that is frittering away power, the over-loaded subordinate who is always snowed under, the cumbersome method that absorbs too much managerial time, the old-fashioned sales plan that impedes standardisation, growth, and the reduction of costs, etc. Such facts must be ferreted out and faced.

SCIENTIFIC FACTORY MANAGEMENT

Or again, when discussing these weaknesses in British industry and after stating that various basic productions had passed largely under German control : In all these cases the strength of the German position was, largely due to persistent scientific work and organising skill. The success of foreign competition in the miscellaneous trades was ascribed to a variety of causes, and amongst others—to the low cost of production per unit resulting from large scale production, specialisation and standardisation, and to ingenuity in the creation of new demands in the consuming market.

What are the plain facts of this indictment ? Are they not that British industry suffered from inefficient management, mid-Victorian methods in post-Victorian times ? Facts, ugly unpleasant facts must be faced so that we may have more efficient post-war management. Duds and factory deadwood generally must be pruned out.

Rocks ahead must be known and charted. And especially must we recognise that the growing aspirations of labour will inevitably bring about considerable changes in industrial administration. Upon the attitude and enlightenment of the present generation of managers will depend very largely the orderliness or otherwise of their coming. Industrial

WRITTEN INSTRUCTIONS

administration must be studied. It must be raised to a science and given earnest thought by every manager who aspires to manage in fact as well as in name.

Too long have we been satisfied to run our factories and their toiling masses in blinkers. ^{Written instructions,} When we passed the Tom-tell-Dick stage and could not speak to them all, we had not the wit to recognise that we ought to have developed adequate written or printed instructions.

Taylor and his successors set great value on the instruction card and laid great stress on its form. Here, indeed, is scope for much careful thought. A different attitude of mind has to be brought about. Foremen have repeatedly told me they had not read their instructions and that their men don't read instructions. This ignoring of written instructions is simply a bad habit that must be overcome, aided no doubt by an improvement in the instructions !

Without written instructions we cannot establish standards, institute efficient inspection or effectively utilise the specialist to improve processes and reduce costs. Admittedly most large plants have some sort of written instructions or blue prints. But are they so prepared that he who runs may read ?

SCIENTIFIC FACTORY MANAGEMENT

Is sufficient use made of diagrams ? Or is the worker told how long his task should take or what premium he can earn by saving time ?

In this matter of written instructions there is indeed a big field for educative work that, like the seed sown on good ground, will bring forth some sixty-fold, some eighty-fold, and some a hundred-fold (32).

Besides the written instructions for the individual, there is the house organ for general community information. Then there is the whole question of the more comprehensive instructions that ultimately get consolidated into what American industrialists sometimes call the Book of the Plant or the Factory Handbook—a compilation from which may be eventually drafted something approaching a “constitution.”

Lord Rhondda could not have had anything approaching his great success with Food Control had he not known how to put written (or rather in his case printed) instructions into force. Any one who has examined some of the Memoranda for the Guidance of Food Control Committees, especially on National Rationing, cannot fail to have admired the technique of their drafting. Some of these M.G.N.R. are excellent prototypes for general factory instructions—so also their index M.G.N.R. 13. Unfortunately good instructions take a good

PROMPT DECISIONS

deal of time to prepare and are apt to slow things down, especially under any form of opportunist management. Also they tend to emphasise managerial shortcomings in the matter of deferred decisions.

Delayed decisions provide one of the most ^{Prompt decisions,} prolific causes of mental fatigue in business. It matters not whether they arise out of things one ought to do oneself or out of matters referred to a superior. The one awaiting a decision is left with a mental burden not rightfully his to carry. Equally the superior is left with a constantly recurring thought that tends to mind fatigue; and a continued strain is tiring—both mentally and physically.

Managers should therefore consistently aim to make decisions promptly, even though a few may have to be reversed later. If the facts as presented do not appear to justify a quick decision, the matter should be referred back or to some one for other and specific data, and a record kept to ensure its subsequent review.

Mental loads carried forward are like bad debts. They initiate worry. And worry is the visible sign of mental fatigue. Most business worries are caused by inability to cope with responsibilities—in other words, by a man not being master of his job. Or, as John Hart says, those who hesitate are bossed.

SCIENTIFIC FACTORY MANAGEMENT

Prompt decisions then—but not a rapid fire of snap decisions so frequently wrong that subordinates lose their faith and respect for your judgment. Here the industrial psychologist can help us. For instance, Prof. Dill Scott in a very interesting little book (38) has outlined the five main methods by which people decide questions, *i.e.* arrive at a decision :

- | | | | |
|----------------------|---|---|-----------------------------|
| 1. Logical reason | . | . | Benjamin Franklin's method. |
| 2. Reason-authority | . | . | Bismarck's „ |
| 3. Reason-emotion | . | . | Women's „ |
| 4. Reason-suggestion | . | . | Flipped coin „ |
| 5. Suggestion | . | . | Weather vane „ |

In an instructive chapter he discusses which of these methods is used frequently and which occasionally. Always remember that suggestion is better than argument when dealing with a crowd. Also that the function of the manager is much more frequently getting men to do what they know and feel they should do, than what they don't know how to do. Therefore he should suggest more often than he urges. The right suggestion helps and encourages. It may need frequent repetition before it is kept constantly in mind. Frequent repetition has a far greater cumulative effect than lengthy and diverse arguments.

Again, a spirit of frankness, openness, and

APPRECIATING SUBORDINATES

confidence allays suspicion and increases suggestibility, so does a display of humour. In fact, as Elbert Hubbard said, a manager must be a humorist. The humorist is a man who has a sense of values, and to have the sense of values is wisdom.

The great reason for Germany's high efficiency was the care and forethought she showed in training her future industrialists. That it pays to teach men the best methods by which work can be done is a truism. Yet the backward state of the educational side of factory management is startling. Because the average manager fails to train and develop his subordinates, he remains a labourer-in-chief and is a manager in name only. Men, machinery, and minutes ; these are the three elements to be handled. And MEN are most important.

A real manager, says Casson, directs, instructs, plans, creates, organises (12). His business is not to do the work but to get it done. Many managers make the fatal mistake of grabbing all the power and glory in the company—and then eventually find themselves carrying the whole burden of the company.

Here is Casson's tip to managers : Let' go ! Let go much of your power. You only need to hold 51 per cent. Also let go most of your

SCIENTIFIC FACTORY MANAGEMENT

glory—the more the better. To be a Nabob is one thing, to be a manager is another.

Therefore the progressive manager of set purpose develops his subordinates. He encourages study. He starts a Works Library. He arranges lectures. He holds conferences. Some men he sends to see other towns and other works. Other men he persuades to play golf, etc. etc. Why? Because he wants to broaden their outlook or counteract deficiencies of early life—so that his people may the better handle bigger responsibilities and he may get away to think, to visualise his problems from a distance and plan for the future.

Further, no industrial organisation is complete unless every highly placed subordinate has an understudy. The Army has them, so does the stage (66). By the way, it is interesting to note that the “King’s Regulations and Orders for the Air Force” lays it down that the G.O.C. is responsible for the command, training, and efficiency of the forces in his command (§ 51), and the C.O. for the discipline, efficiency, and proper system in his unit (§ 98). Compare also the Army Regulations.

“In the future it will be appreciated that our leaders must be trained right as well as born right, and that no great man can (with the old system of personal management) hope

MAINTAINING INTEREST

to compete with a number of ordinary men who have been properly organised so as to co-operate efficiently " (4).

Harrington Emerson says the American plant is usually over-equipped and under-supervised. What would he say about British plants and their supervision? Something uncomplimentary, I am sure. Most of them want a surgical operation—a scrapping of the obsolete, a vigorous pruning to cut away the dead wood that checks the development of new growths and the rousing of subordinates' normal interest in a progressive enterprise.

No man can rise in this world or give of his best if his interest flags. If neglected, interest finds an early grave. Especially is it important for people who have arrived at the middle period of life to maintain a high degree of interest in their work and a high level of capacity for continuous renewal of interest (40).

Interest
necessary
to
success.

Consequently, managers should study incessantly—books, goods, people, ways, means, and lastly self—so that they may continually progress from the old to the new. Business success depends on excess marginal knowledge—knowing how better than the other fellow. The man who can discover or invent better ways for handling people or making goods is always in demand.

SCIENTIFIC FACTORY MANAGEMENT

The business world appreciates the man who can give his "mind" deeply to a variety of subjects in rapid succession—provided he can successfully dispose of each item as it comes along. This demands concentration, and concentration is built on interest, backed by steady purpose. In mental as in physical spheres the suggestive talismans are "economy of action," "precision," "effectiveness."

The broadest foundation of permanent success is personal intelligence operated by skill rather than by force, for community benefit in part rather than for individual interest, for long-run development rather than personal success.

Right clean to the centre of our souls we must feel that we are MEN, that we each have a marvellous body to be brought to its best, a wonderful mind to be aroused, stimulated, and trained for betterment. For nobody is a man merely because he looks like one. He must act like one.

It is rank treason against self for any one who sees better methods to ignore them and say, "It's none of my business." Nature is everlastingly restless. Every skilled activity has its origin in this restless initiative for new and better ways of doing things. But what we can do depends on what we observe, feel, and

THE GENTLEMAN ADMINISTRATOR

learn, as instincts are trained. Therefore if we are to be worthy members of a new profession and worthy citizens of a reconstructed country, we must read, mark, learn, and inwardly digest such progressive industrial literature as will be found listed in Appendix I.

We must make part and parcel of our daily lives and ourselves :

Emerson's *Principles of Efficiency* (1).

Jones's *Ideals of the Gentleman Administrator* (chaps. x.-xii.) (7).

Casson's *New Art of Management* (chap. vi.) (12).

Haddock's *General Laws*.

Indeed, I doubt if there is a manager living but would benefit from an occasional study of the following maxims, adapted from Haddock's *Business Power* (43) :

Maxims
for
man-
agers.

1. Be personally attractive to all associates, including both those above and those below. This is the **LAW OF MAGNETIC ADJUSTMENT**.
2. Carry out scrupulously the policy of your concern or department. This is the **LAW OF SELF-INTEREST FIDELITY**.
3. Cultivate executive ability and hard-headed practicality, since increasingly large results must be secured. This is the **LAW OF INITIATIVE POWER**.
4. Strive to push forward your business and

SCIENTIFIC FACTORY MANAGEMENT

your associates by sheer inspiration of energy, confidence, and magnetic power without endangering the business or alienating employees. This is the **LAW OF INSPIRATIONAL DRIVING POWER.**

5. Reduce your business to such running order that an inventory of the establishment, branch, or department can be obtained quickly and with the smallest degree of personal supervision. This is the **LAW OF SUBJECTIVE BUSINESS AUTOMATICS.**
6. Be in direct contact with every person, machine, and department of the business—not personally, but by system and through subordinates. This is the **LAW OF ORGANISED OMNIPRESENCE.**
7. Be able daily to offset reports against reports in order to detect errors, malfeasance, or deception. This is the **LAW OF COUNTER-REVELATION.**
8. Eliminate business leakage, prevent unnecessary waste and, as far as possible, utilise unavoidable waste, so as to increase the scope of the enterprise and multiply financial returns. This is the **LAW OF DEVELOPING MANAGEMENT.**
9. Know the relation of the business with other businesses needful to it and seek to make it first amongst its kind. This is the **LAW OF FINANCIAL COMPREHENSION.**

LAWS OF SUCCESS

10. Know markets, materials, supply and demand, competitors, outputs and future probabilities. This is the LAW OF LARGE FINANCIAL DETAIL.
11. Develop initiative, business mentality, commercial memory, practical imagination, the energy of success and practical ability. This is the LAW OF PSYCHIC MASTERY.
12. Know yourself and other people. This is the LAW OF ULTIMATE SUCCESS.

SUMMARY

Or, summarising, we may conclude :

1. That the chief task of the manager is the co-ordination and regulation of other people's activities—preferably through a small band of specialists whose development he continually aids so that he himself may shake off routine trifles.
2. That the industrial world is witnessing the rise of a new profession, viz. the profession of Industrial Administrators—of which present-day factory managers should strive to become worthy members.
3. That this new profession will approach its problems in a scientific spirit by—
 - analysing them into their elements ;
 - establishing standards for the measurement of efficiencies ;
 - collecting extensive and adequate data ;
 - classifying facts by their basic nature ;

SCIENTIFIC FACTORY MANAGEMENT

grouping them to reveal agreements
and differences ;

discovering therefrom new facts by
induction, deduction, and analogy.

4. That one of the best analyses, so far, of a
factory's corporate task discloses seven
main functions :

3 productive	.	.	Design, equipment, and operation.
3 facilitative	.	.	Comparison, control, and finance.
1 distributive	.	.	Distribution.

of which the most developed are the
productive and the least the facilitative.

5. That analysis of personnel responsibilities
discloses some five fairly well-defined
gradings :

1 advisory	.	.	Consultative committees or outside experts.
2 regulatory	.	.	Determinative and administrative management.
1 supervisory	.	.	Executive foremen and depart- mental heads.
1 operative	.	.	General body of workers.

6. That the relationships of these various
elements can be best shown graphically
in an Organisation Chart, applicable to
all factories and works that have passed
the traditional management stage.
7. That an Organisation Chart, being primarily
• a graphic record of individual or group
responsibilities, helps to avoid con-
flicting instructions from people of
supposedly equal authority.

CHAPTER III

THE FUNCTIONS OF FOREMEN

THE chief task of a foreman is the supervision and teaching of his people.

In this task he is right up against the greatest factor in business, viz. Human Nature. In the handling of people he is entitled to every assistance his manager can give him. In fact, the foreman's problem differs from the manager's in degree only.

First of all, let me again emphasise the suggestive value of a sound organisation chart. The need for classification. And inasmuch as it reacts on both managers and foremen alike, I will stress it now.

The first service of any good classification is that it enables the men using it to shake themselves loose from prejudices. Similarly, any chart built on such classification helps the users to escape from particular routine, to see all activities involved in their true relations and proportions, and to sense the broad problems of the business as a whole. It emphasises the importance of those facilitating activities so often administered hap-

SCIENTIFIC FACTORY MANAGEMENT

hazardly—mainly because the consequences of their neglect are slow to appear.

In other words, then, a good classification or chart makes for the greater automacity of routine and leaves the user freer to deal with those significant symptomatic details that shape future activities.

Similarly, though possibly in a lesser degree, it is advantageous for each department to have its own more detailed organisation chart, so that foremen and departmental heads may gain a maximum freedom for dealing with the symptomatic details of their own spheres and more particularly the rectification of defective supervision or deficient instruction.

Now all this is not just impracticable theory but practical common sense. Charts do not of themselves make things, but they do help people to get things made and done. To-day no architect puts up a building without preparing a plan (26). No mariner leaves port for distant lands without charts and tables. Equally no industrial manager or foreman should be expected to embark on a big scale task without a satisfactory organisation chart and without means available for gathering adequate records.

Up to the present British industry generally has undervalued such staff work and under-

TYRANNY OF DETAILS

rated facilities of this kind. We have not hitherto felt strongly enough the urge towards big units, known efficiencies, or economising mental efforts. To traditional management such things are the abstractions of theorists: To scientific management they are concretes.

What are a foreman's duties under traditional management? In his book on *Factory Efficiency*, Casson suggests they are very nearly everything that has to be done—attending to output, discipline, fitting men to jobs, fixing rates, paying his men, discharging the unfit, giving out work, getting materials, setting up new jobs, teaching new workers, preventing soldiering, getting repairs made, keeping records, etc. etc. (12).

Excessive demands of traditional management.

In the small factory or department all this is not so formidable as it perhaps sounds, since the details, being comparatively few in number, are readily borne in mind. But in a large shop the details bulk so largely and differ so extensively that, unless they are committed to paper, track cannot be kept of them. What is the result?

In expanding shops the traditional foreman must continually initiate fresh records. More often than not he tries to keep them himself. In short, he becomes part clerk and part foreman and part something else.

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Instead of being on the floor of the shop among his men, he is at a desk doing work for which he was neither chosen nor trained, and for which he probably has neither aptitude nor inclination. And his men ? To a great extent they are thrown on their own resources, doing their own planning, and frequently having to teach themselves. This is no exaggeration.

So-called skilled men have told me that, except for preliminary instruction in their first half-hour or so on a new machine, they had had no further teaching from their foreman. He apparently had no time to give it them. And because foremanship was mixed up with managerial duties and junior clerking, his firm deceived themselves into believing their overhead expenses were low.

Qualifica-
tions of
foremen.

What are the qualifications of a first-class foreman ? According to Taylor (3) the well-rounded man must have : (1) Brains ; (2) education ; (3) special or technical knowledge, dexterity or strength ; (4) tact ; (5) energy ; (6) grit ; (7) judgment or common sense ; (8) good health. Men with three of those qualities well marked can be hired at any time for a labourer's wage ; men with five are hard to find ; while those with six and more are rare.

EMPHASIS ON TEACHING

In addition, then, to some five at least of these qualities relatively well marked, a first-class foreman must be able to concentrate upon small things, to visualise the work at every stage—and even before it begins, be honest, a master of detail and of at least one trade (32). Above all, he should understand the art of handling men (14).

In Dr. Gilbreth's list of foremen's duties we find some forty items. No one foreman should be charged with the lot in any but a small department. In a large plant they should be variously spread amongst functionalised foremen or specialists, each of whom should have three qualifications :

- (1) be a specialist at the work he has to do ;
- (2) be a good observer, able to note minute variations of method, work, and efficiency ;
- (3) be a good teacher.

Under a system of Scientific Management as compared with Traditional Management we find increased emphasis on

- (1) the special knowledge required ;
- (2) the type of criticism necessary ;
- (3) the importance of teaching.

Again, ought a foreman to be big or little ? Other things being equal, the big man has it,

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especially if he has to control a troublesome crowd of men. Size and carriage inspire awe, and unconsciously strengthen authority. But—large physique will not in itself suffice for the efficient handling of men.

Smallness of stature often accompanies a sturdy frame. Further, it causes men to make a special effort to develop their intellectual forces, skill and diplomacy—in other words, the art and science of generalship.

Napoleon, one of the world's greatest commanders of men, was of comparatively small stature. Or to take two industrial examples : we have Andrew Carnegie, the steel wizard, and Lord Weir, the aircraft magician—" Good goods in a small packet."

Consequently this question of size depends partly on the nature of the work to be done and partly on intellectual accomplishments, ingenuity, and skill.

Dominant types - positive, magnetic, and negative. Generally speaking, supervisors can be classed as belonging to one of three dominant types, whose chief qualifications have been listed as follows :

(a) *Positive*—

Arrogant and compulsive.	Capricious and critical.
Captious and harassing.	Hasty and inconsiderate.
Satirical and egotistical.	Impetuous and irritable.
Sharp and observing.	Opinionated and self-centred.

THE MAGNETIC BOSS

(b) *Magnetic*—

Energetic and aggressive.	Diplomatic and appreciative.
Deliberate and firm.	Sympathetic and considerate.
Sagacious and accurate.	Truthful and honest.
Resourceful and persevering.	Loyal and just.

(c) *Negative*—

Gentle and social.	Assuaging and consistent.
Reflective and circum-spective.	Forbearing and conscientious.
Educational and sapient.	Genial and sensitive.
Philosophical and persuasive.	Steadfast and subservient.

The positive “boss” tends to be an arbitrary, aggravating driver. This type is usually in charge when strikes occur. The negative “boss” tends to be congenially conventional and too easy-going. This type is usually in charge when businesses go under.

The magnetic “boss” is the happy mean, who is most successful in drawing and holding the confidence and goodwill of the vast majority of his subordinates, while at the same time creating and exacting their best efficiency.

Or yet again, W. J. Deeley has some very sound views on a foreman’s requirements. He deals with them under the following heads: (1) to possess skill as a worker; (2) not to do the work himself; (3) to be responsible; (4) to be able to understand a problem thoroughly. Indeed, his ideas generally are worthy of very careful study, for not

SCIENTIFIC FACTORY MANAGEMENT

only has he had experience in the employment departments of two large British firms, but he is far from being tradition-bound (53).

Functional
foremen.

Taylor's analytical mind soon came to the conclusion that the duties of an average "line" foreman in a large department are too varied for effective supervision of the workers. Every rational being must recognise that it is bad policy to keep a man immersed in papers when there are operatives around him constantly in need of some one watching and coaching them. Yet how often do we find foremen of large departments spending the bulk of their time doing purely clerical work.

In Taylor's system of management, the work was divided as to Planning and Performance under eight functional foremen :

Planning—

1. Order-of-work clerk, who routes material through the various processes.
2. Instruction-card man, who fills in details as to speed, tools, etc.
3. Time and cost clerk, who makes up pay roll and determines costs.
4. Shop disciplinarian, who deals with disputes.
With auxiliary time and motion-study men.

Performance—

5. Gang boss, who is responsible for teaching men and getting output.

TAYLOR'S FUNCTIONAL FOREMEN

6. Speed boss, who sees machines are run at speeds called for by instruction cards.
7. Repair boss, who keeps machines, tools, etc., in repair.
8. Inspector, who has jurisdiction over process methods and finished product.

In small plants, of course, the gang boss must assume the duties of the speed boss, etc. etc. ; in fact, he is the descendant of the old-time "line" foreman.

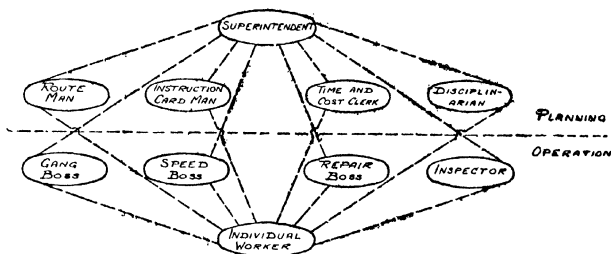


FIG. 4.

Taylor's eight functional foremen do not exercise anything approximating A. H. Church's manufacturing functions (p. 46). This double use of the word "function" is at first sight unfortunate and apt to be confusing. But in the chart I advocate (Appendix IV.)—

Design	would take	motion study men.
Equipment	„	repair boss, speed boss.
Operation	„	gang boss.
Comparison	„	time and cost clerk, inspector.
Control	„	order of work clerks, instruction-card man, disciplinarian.

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Briefly, the sum and substance of any such scheme as Taylor's is that the line foreman is relieved of responsibilities for several facilitating and supply services, and thereby enabled to concentrate on coaching his people and getting output to approved standards. When this change is effected, the gang bosses, etc., must have data supplied to them, or there will be a recurrence of the overloaded foreman trouble.

Handling
men.

But however well we settle our standards, however ably we construct our records, however skilfully we operate our materials or plant, or however ingeniously we organise our staff, we have to recognise that from a foreman's and indeed from the general factory point of view, these problems are as nothing compared with the rock-bottom problem of handling people.

It is because no one has analysed this problem into its elements and succeeded in reducing these to a series of readily assimilated principles, that industry still pins its faith to the old belief that "leaders are born and not made." It is perfectly true that nature does endow some men with leadership qualities more richly than others : and that this gives them an enormous initial advantage.

Handling men is an art. Like any other art, it has to be studied until a body of principles

HANDLING PEOPLE

can be established that will make it a science. Natural gifts have to be exercised and trained. "Born" leaders may exercise and develop their gifts unconsciously, but average men must do so knowingly and preferably with guidance.

"Can he handle men?" and not "Can he drive men?" is the question that will more and more be asked by progressive managers about prospective foremen. The "Lump-it-or-leave-it" attitude is no longer good enough. Nor does handling men mean "firing" on the slightest provocation. Any fool with authority can discharge people. It means rather the bringing round of unruly, touchy, or careless, etc., operatives to a play-the-game frame of mind. It is much more a case of right feeling and witcraft than of right witcraft and feeling.

One day last autumn I was in a railway carriage with some five Colonial soldiers who were conducting a lively discussion on officers. One of them, a New Zealand Rifle Brigade private, summed up the matter so well that I pulled out a note-book. This is how he put it:

"I don't care what any one says, but if a leader of men treats men as men, he can get work out of them. And what's more, they'll always try and get him out of a mess." Isn't that a bull's-eye? Again:

SCIENTIFIC FACTORY MANAGEMENT

“ To run a lot of men with so many different temperaments is a great art. A man to be a successful officer must be broad-minded, make allowances for different dispositions and not indulge in personalities. ‘

“ Here’s a little point. We had a decent fellow as an officer, but he never thought of giving us “ Stand easy,” and the men were getting very fidgety over it. One morning I said to the corporal, ‘ Why not pass the tip to the officer ? He’ll get more work out of us.’ Did he take it ? Of course he did. He was a decent chap and it was only thoughtlessness.” In the end they agreed that leadership was a tough proposition, with a thousand and one things to be borne in mind.

Attitude
towards
workers.

Most of the published accounts of a foreman’s duties dwell upon the advisability of his being broadly skilled in every detail of the work he has to supervise, possessing good executive ability, being able to look after details, etc.

Not nearly sufficient stress has been laid on the necessity of his treating his men as men. They should be led to feel they can at any time go to him for counsel and sympathy, and that if his own knowledge of affairs is insufficient they will be taken to higher officials and guided rightly. If a foreman gets his men’s goodwill and respect he will not find much difficulty

ABRAHAM LINCOLN'S ADVICE

in exacting thorough workmanship done economically.

As Casson says, the average foreman's work is really a score of professions. . . . He does work for which he has not been trained. If it were not for his skill in making excuses, he would never pull through at all. . . . A foreman must work in harmony with the manager : and he must have the loyalty and goodwill of his own men. These are the two chief duties of a foreman (12).

The foremen, in short, are the finger-ends of the management. They touch the workers. Much depends on that "touch" !

Abraham Lincoln knew how to deal with men. Have you read his advice ? " When the conduct of men is designed to be influenced, *persuasion*, kind, unassuming persuasion, should ever be adopted. It is an old and true maxim that a drop of honey catches more flies than a gallon of gall. So with men. If you would win a man to your cause, first convince him that you are his sincere friend. Therein is the drop of honey that catches his heart. . . . On the contrary, assume to dictate to his judgment or to command his action, or to mark him as one to be shunned and despised, and he will retreat within himself, close all the avenues to his head and heart : and though

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your cause be naked truth itself, and though you shove it with more than Herculean force and precision, you will be no more able to pierce him than to penetrate the hard shell of a tortoise with a rye straw. Such is man, and so must he be understood by those who would lead him even to his own best interests ” (38).

Selection
by
workers.

The tendency of the times in which we live are away from arbitrary autocracy and towards what—for want of a better phrase—I will call constitutional democracy. That is how we choose our town councillors, county councillors, and members of Parliament. And I do not think it requires a very vivid imagination to picture the possibility of workers ultimately selecting their own foremen, or at any rate a committee of workers and management doing so.

This is not a new idea. W. J. Deeley has devoted a page and a half to the subject. He has even instanced some Yorkshire mills as having already chosen their foremen.

Choosing their own foremen will not, of course, suddenly change cunning, lazy workers into broad-minded, energetic citizens. But it will call their better qualities into play, and throw on the general body of workers a new responsibility, namely, the responsibility of justifying their choice. Moreover, the resulting

THE HUMAN PROBLEM

wide search for potential foremen could not but very substantially raise the general level of foremanship and at the same time teach workers something of its attendant worries. And after all, why should not the selection of a foreman rest with the ruled? Nor will the suggestion seem so startling when you have lived with it for a while!

A factory's main problem is human nature.

It is the biggest problem managers and foremen have.

And its better understanding is their paramount duty.

Fortunately, the industrial psychologist, both lay and professional, is beginning to help us (39). Prof. F. W. Taussig of Harvard University, for example, has written a very interesting little book on the instincts that actuate men in business (40). Again, Prof. Dill Scott has very ably examined the methods of influencing men in business (38). But to my mind the book that will cause its author's name to go down through the ages is Casson's *Human Nature* (14).

A foreman's work brings him right up against this problem of human nature in all its most primitive forms and in bulk. For he is not merely a fingerpost to point out. He is a

Helpful
man-
agers

SCIENTIFIC FACTORY MANAGEMENT

finger-end. He must observe, guide, teach, and touch human beings. He must give definite orders and see that they are carried out.

If these orders of his relate to materials, he should be able to carry on without much reference to the manager or the specialist staff—except in the handling of new products. But on questions relating to the handling of his men he should at all times be assured of a sympathetic hearing. Such matters should frequently be the subject of conversation between managers and foremen, so that :

- (a) foremen may have the benefit of the manager's judgment and wider man-experience, and
- (b) the manager may have constant opportunity of coming into direct contact with the workers.

Too often matters are reversed. Managers are ready to discuss problems in the handling of materials, but do not want foremen to bother them with questions relating to the handling of people.

Consequently, there is not nearly enough imagination employed to forestall labour troubles, to find and remove just causes for grievance, or provide an effective substitute for the old personal relationships between workers and boss—labour and management.

DEVELOPMENT OF FOREMEN

As I have already tried to show, the manager of the future will concentrate more on organising men than on organising material. We shall find him lending a ready ear to worker questions, and bearing in mind :

- (a) the underlying significance of the findings of the Committee on Industrial Unrest : “ Wholly unfounded suspicions are often causes of unrest, and can only be allayed by prompt and frank treatment, by publicity and by a readiness of every one in authority to offer open explanation.”
- (b) the need for aiding the development of his foremen as efficient leaders of men.

The best developer of a foreman's character and service is a manager's continuous appreciation of his value—not fulsome flattery, but discriminating commendation where commendation is due. Above all, he should not be reproofed in the presence or hearing of his men unless, in the phrase of the Army regulation on the reproof of N.C.O.'s (§ 437), it is necessary for the benefit of example that the reproof be public.

We have seen that Scientific Management involves the development of the facilitative functions, Comparison and Control, or expressed

Access
office
records

SCIENTIFIC FACTORY MANAGEMENT

in the terms of their more familiar components—the development of inspection, costing, routing or planning, instructions, and statistics generally. These latter are of workmanship, costs, stores, wages, outputs of men and machines, time and motion studies, or, in short, of all the various details and records that go to the establishment of standards and close working thereto.

In the later traditional or earlier transitional stage, such records as exist are mostly kept in the workshops or factory itself. Both from a managerial and the general development standpoints this is soon found ineffective. It may simplify their collection. But it hampers their proper collation. And it certainly prevents their economical handling and the installation of modern appliances for their quick utilisation.

Consequently, common sense ultimately demands their concentration in special departments. Only then can they be thoroughly analysed. Only then can the searching WHY be effectively applied.

In other words, Scientific Management necessarily leads to the parcelling 'out of the traditional old-time foremen's duties among a group of specialists and their removal in part to other places. Supervision and teach-

EFFICIENCY WITHOUT STRIFE

ing remain the particular province of the foreman, and in that it is for him to become a specialist. "In meeting the change of conditions in that spirit he need fear no competition or feel any resentment" (27).

But, and it is a big but, the successor to the old-time foreman must have access to these office records, so that as occasion requires he may from time to time supplement the results communicated to him.

For supervision is not summed up in the mere exercise of authority. It is much more. It is the handling of a body of men to get efficiency without strife. And that involves a knowledge of FACTS about both men and materials—such facts as is the special task of the facilitative functions to collect and circulate.

Again, as John D. Rockefeller, Jr., asked in an ^{Team} address on "The Personal Relation in Industry," ^{play.} at Cornell University, "Can you imagine a successful football team composed of strangers having no common cause inspiring them to strive for victory? Team play, the support of one player by another, would be well-nigh impossible." •

Team play in industry! Why not? As a sports-loving nation we all appreciate its value in games. The half-back "feeds" the forward, the centre forward passes to his wing

SCIENTIFIC FACTORY MANAGEMENT

man, and the goal is scored. But it is scored by skilful combination and not by the clever efforts of a selfish individual. Why not team play in the factory ?

We all have the herd instinct. And we all have something of the civilised herd instinct we know by the name of team play. Why don't we make more use of it in the factory ? Why don't managers and foremen coach their teams and aim at the scoring of industrial goals by "combination" ? Is it through ignorance ? Is it through lack of imagination ? Or is it through managers and foremen being under the delusion that they are something superior in mind or morale to the rest of the work force ?

As Casson reminds us in the last chapter of *Human Nature* (14), we are all the same physically—King and Coster. Every average man has 500 muscles, 200 bones, 4 gallons of blood, 25 feet of intestines, and a heart that beats 72 times a minute. Ah, that heart ! We all feel. And our individual feelings are very much alike.

Why don't we do as much to develop the factory heart-power as we do to exact its hand-power and its brain-power ? How is it to be done ? By staff training, mass meetings, workshop committees, and the square deal

SOCIAL EMULATION

in all matters. Every human being responds more quickly to love and sympathy than to authority and the display of distrust. If only our foremen and managers were chosen because they "liked men," as nurses are chosen because they "like children," we should not have those devastating strikes that cause so much mental and moral anguish—to say nothing of material loss.

"Certain it is that an attitude of co-operation and sympathy with one's associates, ^{Group stimulation.} whether they be leaders or equals, contributes immensely to the satisfaction from tasks jointly undertaken. . . .

"Group interest and group stimulation are psychological factors of no mean interest. The employer himself feels stimulation: he is playing the game on his own account: therein lies no small part of the attractiveness of his work" (40).

The United States Steel Corporation found in rivalry between its different plants for a "record" an effective spur to increase of output, and so to diminution of expense.

In the construction of the Panama Canal, Colonel Goethals put the army engineers in charge of the Atlantic division against the civilian engineers in charge of the Pacific division, published the steam-shovel records, and

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thus "hoped to arouse" a wholesome rivalry between the two and secure better results both in time and money.

Can we doubt that rivalry of this kind not only "secures better results," but adds zest to men's work? Even though we may not have the Carnegie psychology and consent to fly a broom at the masthead of winning plants, why should we not fix departmental efficiency standards and publish particulars of the top scorers?

Admittedly, it is difficult to arrange world championships in ship-riveting: any conditions we can devise will to a large extent be artificial. But can we deny the immense interest they arouse or the stimulus they afford? Social emulation is a force of extraordinary strength. That great psychologist, William James, asserted that nine-tenths of the work of the world is done by it. The wish to be considered a member of a superior set appears in every organised aggregation of human beings. Its manifestations are endless. Why not recognise that factor in the factory?

Every competitor in athletic sports does not expect to win. Very few of them, however, grudge the winner his victory. On the contrary, competitors and spectators alike find enormous satisfaction in the sports for sport's sake. On

SKILFUL COMBINATION

the part of both players and spectators there is a passionate demand for fair play. It is this spirit of the sports world that we want in workshop and factory.

We have shown ourselves patriots in war ; why not be patriots in peace ? Why shouldn't we aim at skilful combination between Capital keeping goal, Management playing full back, Foremen playing half-back, and the general body of workers playing forward ? Why not team play for patriotic reasons ? Surely the dullest amongst us has imagination enough to foresee something better than we now possess.

One of the pleasing symptoms of the gradual humanising of industry is the greater interest taken in the prevention of accidents—as evidenced by Anti-Accident Associations, Safety First Campaigns, etc. (69).

Responsi-
bility for
accidents.

While many of us have felt little more than a passing sympathy for the youth or man who loses a finger under the knife of a machine, there are few of us who have not felt some strong sense of resentment at seeing a girl so maimed. Our better instincts are aroused and we become more inclined to look into the whole matter of accidents.

Though everything possible may have been done by the management in the way of providing safety devices, every foreman should

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recognise that he has a part to play that no appliance can replace. It involves an extra responsibility—but it is one that should be encouraged by every and all means. As supervisors of men and work they have to consider “safety first” in the daily routine of workers.

The necessity for prompt, shrewd, yet sympathetic investigation of every accident increases yearly. For not only is the number of accidents increasing, but the percentage of accidents to workers is going up—and will continue to do so with the increase of machinery unless active steps are taken to prevent it.

Out of 7500 shop accidents investigated by the Industrial Commission, Wisconsin, U.S.A., it was found that only one-third could possibly have been prevented by any safety device. The remainder then could have been prevented only by increased care on the part of the workers, by improved conditions, or by better supervision.

Among improved conditions can be cited better lighting of work zone (12), adequate heating, better arrangements for work manipulation, the use of coloured machinery, suitable clothing, etc. Accident prevention means forethought: inquiry into causes for and the removal of dangerous conditions before further

HUMANISING INDUSTRY

calamities occur. Deeley prints three interesting investigation reports that contain some good proposals and instructions to foremen (53).

Accident prevention and treatment is but one phase, however, of the humanising of industry and the growing recognition of its humanitarian obligations. Paradoxically enough we have to thank the war for the increased interest in industrial welfare. To-day no large self-respecting factory is without conscious welfare activities. Since the publication of Miss Dorothea Proud's *Welfare Work* (49) in 1916, a new profession has arisen. Its chief exponents are rapidly formulating principles and prescribing practices.

Welfare Work was forced to the front by the necessity of improving the conditions under which munitions were produced, and the movement is spreading. Some excellent recommendations have issued from the Ministry of Munitions Welfare Department—the pity is they are not enforced (93-97, etc.).

Every factory should have such conveniences and facilities that the managing director would consider them satisfactory for his own sons and daughters. Dirty factories mean dirty people: and dirty people never make a clean product. *The Organiser* for Sept. 1918

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had three good illustrations of factory installations for drinking, washing, and storing of outdoor clothing: the latter, a device of suspended racks, should appeal to managers where work space is limited.

Prof. H. J. Spooner, in his informative little booklet on *Industrial Fatigue* (61), suggests some nineteen duties for which every Welfare Supervisor should be responsible. They were reprinted in *The Efficiency Magazine*, with some rather startling suggestions for the propitiation of the many members of the female sex now brightening the murky gloom of city offices. Again, Prof. Sidney Webb's *The Works Manager of To-day* has some good observations on Welfare Work (8). In short, managers and foremen cannot afford to neglect the study of Welfare Work.

Mistakes have been made and will continue to be made. But welfare or betterment work represents the employers' official recognition of their moral and social obligations towards the general body of workers.

You will have noticed the emphasis I have throughout laid on the human side of industry. Not because the material side is unimportant. But because the human side will be the emphasised feature of the near future.

BROADENING OUTLOOKS

Now hermits don't learn leadership. Small factories don't set up satisfactory standards. Neither do men confined to their own departments become efficient functional foremen.* That way makes for narrow-minded autocratic bullies, lackadaisical charge-hands—but not efficient foremen. Botany is not learnt from a single geranium in a back-garden, nor efficiency from a single cranium in any one workshop.

Every seventh year a German professor is, or used to be, entitled to a year's holiday, so that he might travel and see how other men did work like his own. That inculcates breadth of view and stimulates men to fresh efforts.

Don't mistake me! I am not suggesting industry can follow this example in its entirety. But it can in part. In fact, I understand some British foremen have a day a month in which to visit other departments or plants. While again, other factories have their foremen's room with library, where each foreman is expected to spend a certain time per day. Others again have Staff Training Courses and Lectures. But perhaps the best, because apparently the most immediately practical, way of helping a foreman's growth and increasing his usefulness, is the regular holding of foremen's meetings.

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In some factories these are held weekly : in others again for half an hour daily.

There is of course one common objection to committee meetings, whatever their purpose. I mean the interminable argumentation to which they often give rise. For that there is a definite remedy, however, and it is one that industry must apply to its own meetings. Every satisfactory meeting has a good chairman and a definite agenda !

Teaching
under
Scientific
Management.

One of the points to be strongly emphasised at these foremen's meetings is the need for constant teaching. L. M. Gilbreth thus summarises the need (32) :

1. Worker may not observe his own mistakes.
2. Worker has no opportunity under the old industrial conditions to standardise his own methods.
3. Worker must know standard practice.
4. Waste can be eliminated by teaching.
5. Right habits can be instilled.

The methods of teaching under Scientific Management are :

1. Written, by means of—
 - (a) Instruction cards, telling *what* is to be done and *how*.
 - (b) Systems, explaining the *why*.
 - (c) Drawings, charts, plans, photographs, illustrating methods.

METHODS OF TEACHING

- (d) Records made by the worker himself.
- 2. Oral, the teaching of the functional foremen.
- 3. Object-Lessons—
 - (a) Exhibits.
 - (b) Working models.
 - (c) Demonstrations by the teacher.
 - (d) Demonstrations by the worker under supervision.

The best teachers of industrial processes are skilled workers who possess some natural gift for teaching.

The necessity for rapidly enlarging the British Army and quickly training its officers, ^{Training in fore-} ^{manship.} of both commissioned and non-commissioned rank, led to the holding of many excellent instructional courses and the publishing of manuals. N.C.O.'s, lieutenants, and generals were repeatedly sent back from the firing-line, while the manuals found many purchasers, both military and civilian. Some of them are excellent, and with no very great adaptation might be utilised as factory manuals.

But though we are an industrial nation and have been prominently so for more than a century, I have not yet heard of any foremen owning a Manual for Foremen.

I will go further and suggest that the

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Ministry of Munitions missed a good opportunity of rendering a great national service. But at any rate here is definite work for any successor to the Ministry of Reconstruction. If such a body would undertake the preparation of such manuals and utilise the services of a dynamic publicist to drive home their salient features in 18-point announcements, British industry could be reconstructed in a fraction of the time that will be required to do it by blue-books and white papers.

Again, we have school teachers' manuals by the score, and our school teachers are trained in State-aided institutions—to teach. Why should not foremen be similarly trained? Their number is legion: their work has a distinct psychological basis: it is vitally connected with the national well-being. Presumably the reason for our having no well-established text-books on foremanship is to be found in the underlying truth of the saying: "The Englishman never thinks while he has anything else to do." Foremen and managers have found so much to do they have not thought it worth while to analyse a foreman's duties and set them down for posterity. They have not stopped to think foremen should be trained for anything but the handling of materials.

TEXT-BOOKS ON FOREMANSHIP

However, I look forward to a time in the near future when this omission will be made good—if not by foremen themselves, at any rate with the aid of their associations. In such a book we shall find “Hints to Young Foremen,” such as Deeley gives, p. 128 of his book (53), and the “Ten Rules for Foremen” that Casson gives on p. 142 of *Factory Efficiency* :

1. Be fair—have no favourites.
2. Make few promises and keep them.
3. Don't waste anger—use it.
4. Always hear the other side.
5. Don't hold spite—forgive.
6. Never show discouragement.
7. Notice good work as well as bad.
8. Watch for aptitudes.
9. Be an optimist.
10. Take your full share of the blame.

SUMMARY

Or, summarising, we may conclude :

1. That the tendency of industry towards bigger units demands a more logical subdivision of management and more exacting demands on foremen.
2. That Scientific Management seeks to supply this demand by keen analysis and subsequent synthesis of its various functions and their operations.

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3. That this logically and naturally brings about a redistribution of the old-time foremen's duties among specialists or functional foremen.
4. That while managers are primarily responsible for co-ordination and regulation, foremen are primarily responsible for supervision and teaching.
5. That a wider recognition of the human side of industry will be an emphasised feature of the future.
6. That just as there are service manuals for Army officers, so there should be industrial manuals for both managers and foremen.

CHAPTER IV

THE FUNCTIONS OF WORKERS

WE have now to consider the functions of workers. While theirs, again, may be said frequently to differ in degree from those of the foreman, I suggest they are primarily learning and doing. Not doing only. Nor doing in any old way. But doing in accordance with the best discoverable way. Doing in a new way as soon as a better is discovered. That entails a proper attitude towards learning. Not a don't-teach-your-grandmother-to-suck-eggs frame of mind!

Learning and doing! Learners must be taught, and for industrial purposes preferably more foreman-taught than self-taught. Because a worker can perform a particular operation more quickly than a foreman it does not by any means follow that very material assistance cannot be forthcoming from foremen or functional specialists, who are continually observing different classes of work.

Just as the position of the manager and of the foreman under traditional management is

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Diverse
tasks
under
tradi-
tional
manage-
ment.

so unstandardised that both have to spend much of their time at low-priced functions, so the workers are similarly handicapped. They are not most efficiently employed. They are not systematically put on work for which they possess special fitness or capabilities, neither is such experience as they have gained systematically conserved. This does not mean that good men should be overworked. It means rather that they should be enabled to utilise their capabilities most economically.

Under traditional management, when a worker has finished one job he usually has to ask for the next, often as not different in type, to fetch the requisite materials and tools, maybe reset his machine without competent advice as to speeds and adjustment, to do his own planning, make his own standards, get out of difficulties himself, pass and shop his own work and possibly record it himself—not that this latter is without psychological value. While at any moment he may have to stop what he is doing to execute an errand or take up some rush work.

“Planning” by the individual worker is wasteful. It is an unnecessary hardship on the worker, a handicap to the employer, and a source of increased cost to the ultimate consumer. It cannot fit the broad scheme of

CULTIVATING RIGHT WORK HABITS

planning except by accident and at best causes delays and confusion, since it offers every incentive to scheme for the individual self instead of planning for the greatest good of the greatest number.

Self-teaching by the individual worker is, in short, wasteful. The process is slow and unnecessarily arduous. The accumulated experience of others is not drawn upon. False starts are made. Wrong habits are set up. Tenacity may be strengthened, but adaptability is diminished.

I am not decrying self-training. It is the great character-former. But did not Washington Irving tell us of a Dutchman who, having a ditch to leap, went back three miles that he might have a good run and arrived at the ditch so out of breath that he had to sit down on the wrong side and rest? Learning wants guidance then, and the help of wise preceptors. We can't always have them at our elbows, so we must of necessity all be largely self-trained if we are to succeed in that great training school that is life.

The greatest and most fruitful opening for self-training lies in the cultivation of right work habits, the elimination of waste motions, the right use of human energy. Right here we all want an open mind and a willingness

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to recognise that we individually may have adopted wrong methods. Do we use our arms and body too much ? Do we reach too far ? Do we overstrain ? Has somebody got a better, easier, and quicker way of doing work like ours ?

**Waste
motion.**

Individually we have to remember that industry is essentially the application of motion to materials. The practical problem of business is therefore twofold : to find and eliminate those motions that serve no useful purpose, and to discover and introduce new motions of sound purpose.

Purpose is the decisive test. Its application is not a simple matter, however ; *e.g.* a shoe is subject to less actual motion in a small factory than in a large factory, yet the larger scale production is the cheaper. Shoe motion is increased but human energy is conserved. Does this sound contradictory ? The explanation lies in the substitution of less fatiguing human motion, or, to use a scientific phrase, is psycho-physical, a matter of mind and muscle. On an ever-increasing scale human energy is being replaced by mechanical appliances and machinery.

“Actually, no machine with which human beings are to work can survive in the struggle for technical existence, unless it is to a certain

THE IDEAL WORK ZONE

degree adapted to the human nerve and muscle system and to man's possibilities of perception, of attention, of memory, of feeling, and of will" (33).

Each successful development enables the worker to secure corresponding results with less effort. The fundamental tendency is to transpose activities from the big muscles to the small muscles, from the robust shoulder muscles to the lower arm, or from those of the lower arm to the fingers. Or, psycho-physical energy is conserved, for there is less after-effect of brain excitement in stimulating the small muscles than the big muscles. As expressed in the fundamental law of Fatigue: Physical motions are exhausting in proportion to the distortion of the natural pose of the body.

If we pursue the subject further, we shall come to the conclusion that ideal machines are those that can be operated by the fingers when the elbows rest against the sides and forearms are slightly depressed. It is the position that produces a minimum muscular fatigue. In other words, we want to eliminate bending, stooping, and extended arm work as far as possible.

The least fatiguing work zone is a few inches in front of the waistline, and the ideal machine is the one that involves the pressing of an

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electric button, whether it be for the steering of a ship or operating an industrial mechanism.

That is, of course, a state of perfection to which we cannot often attain. But knowing it to be the ideal, manager, foreman, and worker can frequently make arrangements to avoid workers having to over-reach, seats being too high or too low, and other needlessly inconvenient positions.

Waste motions may be merely superfluous. If so, they are avoidable by altering the chain of habitual movements. It was in this field that F. B. Gilbreth so markedly distinguished himself by his investigations and measurements of men's movements in the centuries-old craft of bricklaying. By eliminating waste motions he made it possible for 30 masons to do the same work as 100 masons had done under traditional methods. His book on *Motion Study* (29) and the collection of papers on the efficient method of industrial preparedness, published last year by himself and his wife under the title of *Applied Motion Study* (30), read like Jules Verne romances. To my mind they contain the germ of some of the most fruitful industrial research the twentieth century has so far seen.

In Gilbreth's own words: "There is no industrial opportunity that offers a richer return

SUPERFLUOUS MOVEMENTS

than the elimination of needless motion and the transformation of ill-directed and ineffective motions into efficient activity."

Every worker should be encouraged to study his or her own methods, to analyse them and continually strive to improve them, to ascertain How many motions are made when doing a particular task; How many are unnecessary; Which are too slow and which too fast.

Elimination of superfluous movements saves ^{Waste time.} time. Sometimes a surprisingly large amount of time! And time is our principal inheritance. In the popular phrase, Time is money. Time multiplied by skill is the commodity we all take to market—manager, foreman, and worker alike. If we can save time we have more goods for disposal, for we get a bigger turnover.

Motion study and time measurements, then, show us how to economise time, to cut out useless wear and tear, and to effect greater results for the same expenditure of effort.

From the first pioneer days when Taylor showed 140 men how to use shovels as effectively as 500 had previously done, when Gilbreth studied the bricklayer's body movements, when he showed a crack exhibition worker at the Japanese-British Exposition how to reduce by half the time required to cover boxes of

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shoe polish, there has been a great advance in the methods of conducting motion study. Until to-day, as readers of Gilbreth's *Applied Motion Study* will discover, the motion study expert has a well-equipped laboratory with elaborated cinematographic appliances.

With the aid of a special clock, motion times down to a ten-thousandth of a minute are recorded. By having small electric lights attached to the operator, photographic records can be obtained showing exact distances, times, speeds, and directions of the several motions made by the various parts of the body. From the data derived, motion paths, habits, and all other motion variables can be minutely investigated and standardised. In other words, right work and rest periods can be established.

One thing is certain: both workers and managers must in the near future learn the real facts about time study. Time is a fundamental element in rate setting and fixing. And rate-fixing is a subject of particular importance to the worker, whether on day-work, piece-work, premium, differential rate piece, task with bonus, or any specialised system (64).

'Accurate time and motion study is the one means by which the real facts of unsatisfactory conditions under traditional management can

A REGRETTABLE HUE AND CRY

be established. It alone affords scientific proof that many trades now unduly exhaust the workers. It alone provides the means for determining right work standards.

Unfortunately for innovations that cut right across old traditions, "it is human to err." And the errors of the early advocates of time-motion study afforded a number of the disturbed, conservatively-minded folk a ready pretext for raising such a storm against Tayloreal Management that the whole subject of time study got under a far denser cloud of suspicion than was ever justified, and a great deal of positive harm has been done.

The outcry in America led to the Hoxie report (15), whilst elsewhere the hue and cry has been taken up by men usually so capable of taking broad views. G. D. H. Cole's onslaught at the Bradford conference of working-class associations in 1917 is a case in point. But if one is to judge from his published reply (83), much of its sting was quickly drawn by G. C. Renold's contribution to the discussion. The latter's very able paper is especially deserving of close and careful perusal. So also several of the articles in that comprehensive compendium, C. B. Thompson's book (17), with its many diagrams and detailed particulars.

Instead of objecting to the introduction of

SCIENTIFIC FACTORY MANAGEMENT

time study—mainly because of its novelty—workers and trade union officials should aim at a thorough understanding of its methods and their application ; they should urge and support Government efforts to secure and publish standard times—just as health records are compiled and published. Time study will establish **FACTS**—Index Facts by which individuals may measure both their own and managerial efficiencies.

Fatigue
study.

Waste motions mean unnecessary fatigue. And unnecessary fatigue is not only an economic waste, but it is a waste of life itself !

Exact fatigue measurement as applied to industries is in its infancy. Our own Ministry of Munitions has already issued various blue-books and white papers on the question. “Industrial Efficiency and Fatigue,” Cd. 8511, for example, is particularly informative. It deals with fatigue and its causes, output in relation to hours of work, day and night work, causes and conditions of lost time, incentives to work (with a concise appendix on wage systems), inquiries into health and physical conditions, etc. When I add that it contains some excellent charts you will gather that, apart from its uninteresting format, it is a good fifteenpenny worth.

Here is part of paragraph 15 : “By studies

CHEMICAL BY-PRODUCTS OF FATIGUE

of industrial fatigue, measured by tests of individual output, a large body of valuable information has already been gained in various countries, and its application wherever management is scientific has become a commonplace of administration.

“It must be admitted, however, that in England—and no doubt to the detriment of both health and wealth—management based upon the experimental science of industrial fatigue is far less common than in the factories and business concerns of America and Germany.”

Fatigue depends upon the accumulation in the system of the by-products of the chemical changes induced by activity. It is not to be compared with the running-down of a clock-weight, but rather with the clogging of the mechanism by dirt. These chemical by-products are removed in part by blood irrigation and in part by other chemical changes. And these changes demand time for their completion (88-9).

Careful observation and records show that a little fatigue is easily overcome if proper rest is supplied immediately. But twice the amount of fatigue requires more than twice the amount of rest. Rest after activity is not a passive state. It is an active process leading

SCIENTIFIC FACTORY MANAGEMENT

to a restoration of capacity for work. Or, in Ovid's phrase : " Alternate rest and labour long endure." So we see that problems of industrial fatigue are primarily and almost wholly problems of fatigue of the nervous system. And the problem of scientific industrial management, dealing as it must with the human machine, is fundamentally a problem in industrial fatigue.

Of the growing literature on the subject, after Miss Josephine Goldmark's masterly volume on *Fatigue and Efficiency* (34), I should certainly place another Gilbreth book (31). The Gilbreths have shown that the best first step in the fight against fatigue is to eliminate the causes of unnecessary fatigue, and the second is to provide for proper rest to overcome fatigue, whether necessary or unnecessary. The various stages advocated by them are embodied in five slogans :

Firstly : Time to rest when one needs it.

Secondly : A seat to rest in.

Thirdly : A seat for every worker whether he needs it or not.

Fourthly : It is your duty to rest when you need it.

Fifthly : Let's go at the fatigue survey altogether.

Fatigue elimination is fundamentally the duty of management. But the workers them-

PERIODICAL REST PERIODS

selves should understand the problem and co-operate in its solution. Every worker should have definitely allocated rest periods. Reclining positions are most restful because they alter the blood pressures. Indeed, flat couches are part of the regular working equipment of some of the world's greatest brain workers.

Don't scoff, reader, but study the Gilbreth book. Start a Fatigue Museum in your factory. Write to the American Posture League, 30 Church Street, N.Y., for standards of proper postures.

Remember how Taylor increased the pig-iron handlers' daily loading capacity from $12\frac{1}{2}$ tons per day to $47\frac{1}{2}$ tons by arranging for them to have regular rest periods. Read how Gilbreth trebled the handkerchief folders' output by making them rest fifteen minutes in every hour. Recall the Trench Digging competitions during the war: how those companies having periodical rest periods got far better results than the companies without rest periods.

“Of all the standardised agencies which a service department can put at the disposal of a general executive, the supreme one is a first-class man” (6). This truth is alike applicable to big and little affairs. Augustus

What constitutes a good worker?

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Cæsar built up and extended the power of the Roman Empire because he knew men. The careers of Charlemagne, Napoleon, Disraeli, Washington, Lincoln, Lloyd George, and all the empire builders and saviours hold their places in history because these men knew how to recognise, how to select, and how to develop to the highest degree the abilities of their co-workers (35).

For years the street dust of Athens has been sifted and searched for relics and remnants of things made by people captained by men of ability, selected by Pericles. Elbert Hubbard said: "Pericles was the one name that had stood out in history like a beacon light for 2500 years, because he had the sublime genius of discovering ability." Pericles, we are told, judged men by a shrewd guess—the kind of guess we call intuition—really the result of keen observation backed by good judgment and trained by shrewd study of large numbers of men until it became instinctively accurate.

The same holds good in industry to-day. John Hanan, the big American shoe manufacturer, said the successful man was he who surrounded himself with brainy men.

Andrew Carnegie's remark, that he won his success because he had the knack of picking the right men, has become a classic in current

RIGHT MEN IN RIGHT PLACES

speech. He made millionaires of men he selected from quite humble positions (62). One of them, Charles M. Schwab, followed the same policy, and in a few years converted a financial wreck into one of the most profitable concerns in the world. In 1912 he made Eugene Grace, a former labourer in the Bethlehem Steel Co., the president of that corporation when only thirty-five years of age. Brains, he said, are a bigger asset than money, and Eugene Grace he considered one of the brightest men in the world.

But humanity in general needs a more scientific method of judging men than it at present possesses. Consequent on our great ignorance about ourselves and our kind, few of us realise the possibilities that lie dormant in each of us. Parents and teachers groping in the dark have long persuaded natural artists to become engineers, natural artisans to become clerks, etc. Equally blindly employers have regularly put naturally good investigators on to routine work, and *vice versa*. In other words, until workers are selected by trained psychologists, misfits will continue.

And wherever misfits forgather trouble inevitably follows.

After all, there is only one legitimate reason for putting any man or woman on the pay-roll,

SCIENTIFIC FACTORY MANAGEMENT

viz. that he or she is well fitted to and will perform their tasks contentedly and happily. Yet efficiency experts assert that in the average organisation only some 25 per cent. are efficient.

Here, then, is a big industrial leakage, a waste of human energy. Wrong men in wrong places ! (p. 172).

A good worker needs careful selection, for not only must his technical skill measure up to the requirements of his work, but the work should properly be suited to his temperament and mental quality. Another counsel of perfection ! And one that cannot be readily followed in this imperfect old world of ours, though much could be accomplished by a more conscious adoption of the principles laid down in Dr. K. Blackford's *The Job, the Man, and the Boss* (35). But I must at present be content with adding that among the chief factors upon which the ultimate success of any employee depends are :

1. Selection of work for which most fitted.
2. Selection of employer under whom worker can do his best work.
3. Study and mastery of the technical aspects of his work.
4. Careful and scientific development of his most valuable character assets.

AVOIDING INDUSTRIAL MISFITS

5. Thorough understanding and application of principles of personal efficiency (2).
6. Accurate knowledge of the character and disposition of superiors (36).
7. Intelligent adjustment of his attitude towards employers and fellow-workers.

Dr. Blackford gives a list of qualities required for positions in various trades and occupations, showing how progressive management is endeavouring to standardise its work-force requirements. Apart from aptitude or actual technical skill, a "good" worker is readily teachable and recognises the value of proper discipline, knowing that no human undertaking prospers without rule and order !

As previously stated, it is one of the merits of "Scientific Management" that it called attention to the absurdly wide range of duties the average foreman was expected to perform. In conformity with the idea of functionalisation, employment departments have now been established in a great variety of businesses, and are charged with supervising a considerable portion of the relations between employer and employed—including "hiring and firing." And the change is all to the good.

The worker is both better chosen and to a large degree freed from arbitrary caprice. While the employment supervisor, having

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many people to handle and fit into jobs of which he can have but a slight acquaintance, perforce analyses industrial tasks, finds out their peculiar features and the qualities demanded of the worker. While his almost impersonal interest in the job has caused him to develop the human side of his work. Having been repeatedly charged with the task of framing labour policies and compiling wage scales, he has learnt that what men seek from industry is not a living but a life, to use Henry Ford's phrase.

Knowing the expense of changing employees, employment supervisors not unnaturally become interested in the question of reducing labour turnovers. They soon find that few men change employment for the fun of the thing; it is too costly. Most men change because of unsatisfactory conditions. These vary in kind, ranging from low wage rates to bad shop tone. But, whatever they are, no one can be more concerned in securing their elimination than the employment supervisor. So both management and workers should welcome his introduction and secure his co-operation.

In every concern then, large or small, employment should be centralised and done by or through an individual understanding voca-

ENSURING 'A PROPER START

tional guidance (73). As advocated by Leon Stein in an interesting and instructive chapter (62), the employment manager should maintain an open door to employees, allowing them to come freely with their disputes and grievances.

Admittedly his is a difficult post, for not only must he be a good judge of human nature, know the environment and requirements of the various positions and the capabilities of their occupants, but he must consistently maintain good relations with all heads of departments and at the same time retain the confidence of the workers (53).

In war the line executive handles the battery, but depends on staff men to provide reliable artillery horses, convenient gun carriages, ammunition, service tables for sighting the guns, etc. Industry is slowly adopting a somewhat similar procedure. When the general manager wants new works, he relies upon the architect for their design; when he wants a new product, he instructs the design department to get out dimensions, etc. Similarly, when general executives want well-chosen men, physically fit and skilled to do their work, properly paid and so handled that they become permanent, contented, and loyal co-operators in the general plans of the enterprise, they are everywhere beginning to turn to

SCIENTIFIC FACTORY¹ MANAGEMENT

another service department—the employment department (see page 173).

On the one hand, general executives and foremen are relieved of the distractions involved in scouring the labour market, and moreover get a more dependable run of workers than they could themselves find. On the other hand, the workers are safeguarded against arbitrariness, provided with a tribune as much concerned in their joint interests as in those of the employing firm and ensured a fair start. Therein lies the employment department's chief merit from the worker's point of view.

selection
and
training.

For a proper start has an important effect on a man's progress in life. It shapes the character, establishes right habits and promotes the right ideals. Yet how many young men and girls obtain their first position accidentally and without much thought as to their own suitability? Once placed, they may continue for years without achieving satisfactory results, either to themselves or to their employers.

Indeed, to have been wrongly selected is a distinct hardship to any employee, for he has not as good facilities as the employer of knowing the requirements of the position. Unfortunately a great many persons are daily performing duties for which they should never have been selected. Nor would they have been, had the

ADVANTAGES¹ OF GOOD SELECTION

local educational authorities given proper vocational guidance, or the employing firms exercised proper care in their selection.

Selecting new workers is a fundamentally important duty. But only too often it is done in a most haphazard manner—hurriedly and by men who have given no close thought to the employment problem. Yet the success of a concern depends no less or even more upon its human work force than upon its mechanical appliances—upon its man-power as much as or more than upon its horse-power.

When men or women have been carefully selected for their position by a well-qualified employment supervisor, the chances are they will succeed. At any rate the employing firm can well afford to devote more time and money to their training. Under traditional management, the head of the department tells a new employee what is expected of him, but very little or no attempt is made to show him how to perform his duties efficiently.

Under scientific management properly so called, on the other hand, he is systematically instructed by persons employed for that purpose (32)—sometimes in a specially arranged department with model appliances, as at the London General Omnibus training schools, or like the Army recruits. Indeed, recent Army

SCIENTIFIC FACTORY 'MANAGEMENT

and munition experiences have shown astonishingly satisfactory results from intensive training and have surely exploded the old idea of lengthy apprenticeships.

Sometimes new-comers are given printed instructions and rules with a view to helping them to settle down more quickly : at others, they are taken round the plant so that they may become familiar with its activities and their own work be found more interesting. For the modern tendency is to encourage employees to think about their work and to put themselves in training for higher work.

This is not philanthropy but good business policy. When once a man's interest in his work is thoroughly aroused, he is enormously more useful to himself, his employer, and the State.

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But the great advantage of good workshop instruction is that it creates right work habits—and these are at all times an asset to the individual and the concern for which he works. Moreover, it is far easier to acquire right work habits if one has not previously learnt wrong work habits.

Actually most workers are anxious to become efficient and are grateful to the employer who helps them to develop and so qualify for higher positions. In addition to their wages they have

THE FIRST STEP UPWARDS

a claim to instruction that will aid their development—not merely as skilful machinists but as thinking citizens.

Each employee in every position, then, no matter how simple the task, should have a fair start and not be handicapped by the withholding of knowledge. People are not horses that they must be run in blinkers. They are entitled to know something of the ideals and the policies of the concern for which they work, and of the industry of which they equally with the managers and foremen are participating partners. While some need watching, the great bulk can be fired with ideals. Indeed, many a worker owes his first big step upwards to aroused instincts for big ideals. When they have learnt that habit is the secret of skill, that by good habits they make a large percentage of their work automatic, thus setting their brains free to think of other things, and that by learning to think clearly about problems connected with their work they benefit themselves and their race, there are few keener enthusiasts for right work habits.

When they realise to what extent the universe runs on habit they find intense satisfaction in helping to standardise operations and, consequently, in stimulating right work habits, both physical and mental.

SCIENTIFIC FACTORY MANAGEMENT

waken-
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lect.

We are in point of fact all the same, workers, foremen, and managers : we sing our Tipperaries when setting out on serious missions : we “go over the top” with joke on lips or gibe on tongue. It is not for the sake of the job itself that we steel ourselves for difficult or strenuous tasks. It is for the ideal behind it—the something that has aroused our latent powers. But just as the manager cannot expect a worker to perform his duties in a satisfactory manner unless he has been instructed and trained, so he cannot expect to release the mainspring of his workers’ latent powers unless he arouses their dormant intellects. They may not have had a high school education, but many of them have had a rare schooling in life—without having consciously learnt the lesson of applying their knowledge to its fullest.

Right here lies a task to the hand of each of us as members of a great brotherhood and sons of a noble inheritance, the task of tickling up each other’s dormant intellects. The manager may do so by means of mass meetings, circulating bulletins, or arranging lectures ; the foremen, by private conversations and talkie-talkies ; the workers, in many another way.

But, however it is done, we can be sure of this. When Britain’s dormant intellects in industry are thoroughly aroused, our country-

AWAKENED LATENT POWERS

men will set a hot pace for other nations. Their inventive genius, their stolid character, and their tenacity of purpose are A1 factors for an industrial team that could again bring us to the top of the world's Production Championship. It is only a matter of right education and right national ideals.

Workers above all others have to recognise that this arousing of latent powers, by which alone their class, their age, and they themselves can thrive, is not to be gained by long drinks at the bitter fountain of class warfare. Along that road lies national damnation. The lesson of Armageddon has surely taught the dullest witted adherent of this doctrine that our future lies in the intelligent co-operation of all sections of society ; in the uplift of the lower stratas and not the annihilation of the higher ; in bridging the gap that separates them, and not in any dog-in-the-manger policy of blasting to the four winds those who happen to have achieved wealth or had it thrust upon them by fortune of circumstances.

In recent years there has been budded off from philosophy a science of the mind. By combining laboratory methods with industrial research, it has gradually accumulated a store of knowledge concerning human actions, the sensory impressions and mental imagery (39).

SCIENTIFIC FACTORY MANAGEMENT

It has told us much of the means of impressing the memory, holding the attention, and arousing interest. It has explained the learning process, and so pictures the various instincts and their corresponding emotions, that we are at last beginning to understand the attraction of matched records and the fundamental idea of competitive games.

So fertile, indeed, is this new science in suggestion that one can foresee the time when progressive workers and managers will want to be well grounded in it and to keep in touch with its evolution.

For we have all to recognise that modern scientific management will lead the worker to bigger thoughts and to increase his usefulness generally. The question arises : What is the best way to direct the growing mind and help it with concrete practice ?

Here is room for a good deal of honest difference of opinion. But the balance is probably in favour of well-arranged suggestion schemes (12). Every establishment has men and women with good ideas and thoughts at the back of their heads—held back for want of suitable opportunities for their disclosure. Once out they would stimulate a succession of fresh crops—increasingly valuable as latent powers disclosed themselves.

DEALING WITH SUGGESTIONS

But worker suggestions, like shy birds, are very sensitive about their reception. They don't readily get drawn into cheerless suggestion-boxes to become the possible shuttle-cocks of secret diplomacy. Above all things, they like open country with a few pleasant shadows from tall trees. For they have had reason to be suspicious of undergrowths and greedy geese, of bad faith and perky cock-sparrows.

Suggestions are, in fact, probably best dealt with by a Suggestions Committee, composed of workers and junior foremen, charged with listing every one received and dividing them into at least three classes :

1. To be tried.
2. Worthy of commendation.
3. Frivolous.

There should be a recognised worth-while minimum tariff for the first two classes, with a generous appreciation for the best suggestions. Nor should any industrial management feel satisfied with the working of a suggestion scheme that failed to produce a yearly average of one suggestion per worker. Suggestions are like any other commodity, subject to the law of supply and demand. The management makes or mars the market.

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The un-
skilled
and in-
efficient.

To-morrow will be the day of big amalgamations, giant combinations, and the pooling of resources, whether material, muscular, or mental—to cut out overlapping effort, to secure increased standardisation, and to facilitate keener specialisation. Factories will concentrate on fewer articles and instal more automatic appliances. More advanced tactics will be employed in every department of human effort, from the purchasing of raw material and its manipulation in the workshop to the distribution of the finished product.

Wider and broader vision will mark corporate and communal activities, as it dawns on humanity that industry as a whole belongs to the State rather than to any privileged groups of individuals.

Neglect of scientific knowledge will give place to a keen competition for its services. Hit-and-miss methods will give place to carefully designed operations, judged by inspection according to established standards. Neglect of labour susceptibilities will give place to solicitude for its well-being.

Ignorant individuals, be they workers or managers, will be more and more recognised as a menace to their fellows and a drag on the community at large. For society is seeking a more co-operative basis for its economic activities.

PROBLEM OF THE UNSKILLED

Or, if we are to hold our own in the twentieth-century world competition, we shall have to give up our loose British way of letting things muddle through by the grace of God and the skill of the strong men of the moment. We shall have to go in strongly for scientific organisation and systematic guidance—for considered judgment of a higher order than marks our present-day proceedings.

In the past we have allowed misunderstandings and ignorance to drive wedges in ranks that should have stood solid, causing workers and managers to lose touch with one another and one another's problems. Those problems will grow bigger and not less. So workers and managers must regain touch and discuss those problems to their mutual advantage. Face to face clears many a case.

Workers and managers, then, have to train or be trained to meet in conference. For it is becoming increasingly clear that diplomacy, politics, and industry have one end in common—to find bases of negotiation wherewith to deal with conflicting forces, parties, or administrations, and to formulate treaties, settlements, and agreements. Rightly regarded, all three can and should be constructive and evolutionary in their trend—not destructive and revolutionary. The more industry de-

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velops, the more keenly will all sections feel the drag of the unskilled and inefficient.

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anship.

All parties know this drag, yet so far few but the crudest steps have been taken to meet the situation.

Under the stress of competition, incompetent managers are asked to resign, but others re-engage them: inefficient workers are discharged, but others employ them—with a lowering of status for the skilled and efficient.

Nor have trade unionists dealt with the question one whit more satisfactorily, or indeed as intelligently as the employer. Nor can we be very surprised. Circumstances have made vote and subscription catching privileged claims with precedence over efficiency—at least that is how it appears to me.

Using G. D. H. Cole's phraseology, the almost haphazard growth of British Trade Unionism over a long period of years to meet special needs—in a thoroughly opportunist fashion (46)—has resulted in so criss-cross a tangle that no ordinary worker can hope to unravel or get the whole into decent perspective.

Prior to the eighties the existing craft unions ruthlessly excluded their less skilled tradesmen, who gradually became absorbed into omnibus unions with all sorts of diverse in-

GRADED 'CRAFTSMANSHIP

terests ; subsequent, and especially the so-called semi-skilled craft, unions have included their less skilled colleagues under a variety of divergent schemes.

Though I cannot pretend to anything like G. D. H. Cole's wonderfully encyclopædic knowledge—and his book does not help me—I believe the Brassworkers' Union is almost the only one that has achieved any success in plans for dealing with the grading of craftsmanship (76). Moreover, I gather trade unionists generally don't like the idea. There, I fancy, they are wrong—except possibly for weight-throwing political reasons.

But I notice that in the selfsame very able short study of the present position of trade unionism in Great Britain, when dealing with the problem of the skilled and less-skilled, G. D. H. Cole himself suggests that the absence of methods for adjusting skilled and less-skilled disputes is likely to prove a serious difficulty in war-dilutee issues.

Is not the big fundamental problem one of graded craftsmanship ? Were not the old-time apprentice, journeyman, etc. divisions essentially craft gradings ? We have Board of Trade certificates for the different grades of mercantile marine—seamen and engineers. Why not Ministry-of-Labour Board-of-Educa-

SCIENTIFIC FACTORY' MANAGEMENT

tion certificates for industrialists, with national wage minima for each grade ? The Army and Navy have such a scheme for officers, N.C.O.s, and proficiency men. Why not Industry ?

Personally, I am persuaded that certified craftsmanship intelligently graded would lead to all-round improvements, encouraging the ambitious, raising the status of the craftsman and protecting the highly skilled against inexperienced dilution, besides furthering industry and generally promoting trade unionism on sound lines.

Right
Grade
Union
deals.

For my own part I believe there is no more important task before both workers and managers than the quick development of right Trade Union ideals. By that I do not mean organisation in separate camps. In law and practice the present associations are trade unions. Yet what a misnomer that title is !

What we are experiencing to-day is organised trade disunion (79). Employers and operatives separately banded together for purposes of aggression and defence, and, until recently, seldom coming together except during a fight. What a dissipation of energy ! What a colossal waste of human effort !

John Ruskin and William Morris long ago pointed out that service to the community,

TRADE UNION IDEALS

work for the common good, is the only real justification for the operations of business. During the past four years we have been brought to realise the absolute necessity for national service and co-operation for the purposes of war. To that end the worst practices of both employers and employees were promptly dropped in 1914.

Is it not time everybody realised that industry is a form of national service and that it is the duty and privilege of all to co-operate? With that principle firmly established there would be a new motive for industrial activity, a beacon light that would point the way trade organisations should proceed. The soulless idea of labour as a commodity to be bought, sold, and scrapped like an old pair of shoes would go by the board. Capital, *qua* Capital, would get its wage or legalised rate of interest and its bonus. Surplus profits would be divided on a juster basis. This view, it may be observed, has been variously put forward by both employers (the Society of Friends, etc.) and workers (Labour Party, etc.) independently, and jointly (*e.g.* the Bristol Conference of Employers and Labour Representatives) (78).

By the way, if any reader has not read the British Labour Party's pamphlet on *Social*

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Reconstruction (84), I hope that he will take prompt steps to make good the omission. Its constructive thoughts on industrial and social reconstruction put the older political parties to shame: they, with immense initial advantages, have not produced anything approaching it—though we may nowadays note its influence in many subsequent publications, such as Lord Henry Bentinck's *Tory Democracy* (52)—to say nothing of such efforts as that stimulating pamphlet *The Industrial Outlook: No Man's Land* (81).

But good idealism as it is, no one can blink the fact that its realisation will be a matter of time and full of practical difficulties. Excess Profits Duty will, however, prove to have been a substantial first step in the foreshadowed direction. Indeed, one might almost prophesy that E.P.D. successors will be drafted to give more encouragement to enterprise while at the same time stimulating proprietors to betterment work generally.

Again, the Whitley Councils will go far to bring about better relationships between employer and employed (91, 98). Their main concern for years will be much more with the conduct, and not the control, of industry. To that extent their recommendations fall short of modern requirements.

STRIKES AND UNREST

For industrial unrest is only in part economic and connected with wage problems. In the main it is psychological and quite as much connected with questions of status, as it is with the distribution of the products of labour.

Many of the psychological troubles of industry arise through ignorance and misunderstandings that could be avoided were management more willing to look at labour problems from labour's point of view, and *vice versa*.

Apart from the social upheavals that so often follow war, it is nearly always wronged men who strike. The immediate cause of a strike may be farcical, foolish, and even immoral. The men may have disregarded past undertakings, turned against their leaders, but they ultimately throw the machinery of civilised life out of gear because they will wait no longer for an answer to a demand that has remained unanswered for a generation.

The industrial unrest of our time is a protest against injustice. It is a symptom of the desire for a better social order. It is the growing pains of a world emerging into a new faith in "equality." Gross inequality exasperates men—especially when it is founded on a system that has so often proved itself inequitable and at times uncompromisingly intolerant. But there never was a time in the

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history of the world when strikes were to be more deprecated and their wastefulness more emphasised.

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trial
guilds.

The ultra-conservative may well feel dumb-founded that many of the keenest constructive minds of the day are apparently going back to the old Craft Guilds for their solution of our troubles. Not, however, a mere restoration of the trade guilds of the Middle Ages, but a modern application. Individual views may vary ; but the progressive thinkers have after all been followed in part by the Whitley Committee. Indeed, the ultra-conservative will find much suggestive reading in books like A. J. Penty's *Old Worlds for New* (51), A. R. Orage's *National Guilds* (50), G. D. H. Cole's *Self-Government in Industry* (48).

It has been frequently argued that our English political genius does not lie in the realms of abstract principle. Yet our ancestors made King John sign the Magna Charta ; they overthrew the Stuart usurpation of political power ; they broke Napoleon ; and our generation has smashed the Kaiser's bid for world power. As a nation we have fought "to make the world safe for Democracy." At the time of their various inceptions, all these motives were most certainly abstract principles.

Our genius lies rather in practical compro-

INDUSTRIAL GUILDS

mises and the constructive work necessary to realise well-defined principles. In industrial matters the war has opened up new spiritual horizons. Exact equality we know we cannot have, either politically or industrially. But to check gross political inequalities we established the Mother of Parliaments. And we now want trade parliaments to check growing economic inequalities. The nation has long experienced a democratic control of politics. It is now seeking a more democratic control of industry.

Both Capital and Labour have to recognise that it is neither the one nor the other that have in the past contributed most to the creation of our industrial wealth. Without the inventor and the organiser we should long ago have been bankrupt. Capital and labour alone cannot create wealth (63). But as a nation determined on industrial reconstruction we have to proceed warily and on lines that won't kill the goose that lays the golden eggs—like poor blood-stricken, storm-tossed Bolshevik Russia. Rich and poor must first and foremost aim at right Trade Union ideals. And all indications point to their being found in a system of democratic Industrial Guilds.

Just as we have Town Councils, County Councils, and a National Council or Parliament, it looks as though we shall steadily fashion

Management
sharing.

SCIENTIFIC FACTORY MANAGEMENT

local Factory Committees, District Committees, and a National Committee for each industrial unit and group, crowned by a League of National Industries.

That means the setting up of Workshop Committees in all large works to ensure personal contact of a succession of representative workers with the management. It will also involve the aims and intentions of the management being more openly and directly laid before all the workers—partly through the Workshop Committees, and partly through notices and house organs. In fact, each large factory must, like the War Office, recognise the necessity for establishing its own information bureau.

Continued hostility between management and worker is indefensible. The proof of a teacher's skill and success lies in the degree his scholars attain in learning to educate and control themselves. Although incapable of immediate achievement, this ideal is a perpetual guide to practice, both for teachers and for managers and workers. "With management elevated into a profession, with promotion dependent on established tests for merit, and with responsibility for others the fruit and seed of self-sacrifice, there can be no doubt that the resulting co-operation would make for progressively greater happiness and

WORKSHOP COMMITTEES

efficiency than would class warfare" —Deeley (53).

Deeley further suggests (pp. 88-89) the following items amongst those for eventual delegation to Workshop Committees :

1. To receive reports of accidents, sickness, absence, lateness, apprentices, and part-time education.
2. To investigate accidents and recommend safety devices.
3. To manage any sick club, scheme for convalescent treatment, canteen, shop collection, war saving, etc.
4. To discuss future holiday arrangements, hours, meals, travelling facilities to and from work, discipline, shop rules, social gatherings.
5. To discuss any scheme for dealing with suggestions from employees, and possibly to recommend payments for the same.
6. To discuss wage scales, bonus, or changes in piece rates.
7. To submit names for promotion to foremen, or to fill vacancies. These names would be considered by the management along with any others.

Though as yet few British industrial concerns have gone so far in their delegation of powers to Workshop Committees, quite a

SCIENTIFIC FACTORY 'MANAGEMENT

large number have already started their Committees with astonishingly wide powers. Nor are they likely to suffer when the Committees have properly settled to their work.¹

Some firms arrange for the members to sit out of factory hours, while others—and I think more wisely—arrange for them in factory hours. Some, again, make no payments—though I am sure they are following a wrong principle, since the Committee is exercising managerial functions—while others remunerate the members, sometimes styled Trustees, either by direct payments or by dividends.

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dustry.

But however such details may now be settled, society in general is beginning to realise that every factory has direct obligations to three main groups. These can be shortly described as proprietors, workers, and consumers. Those who put up their money and risk their savings in the enterprise are entitled to consideration. So also are those who operate the plant and supply the brain and muscle power. And so are those who keep the plant running by buying its products.

The national problem, and therefore the factory problem, is the just balancing of the

¹ Since the foregoing was written the Ministry of Labour has issued Industrial Report No. 4 (6d.), containing excellent suggestions as to the constitution and functions of Works Committees.

MANAGEMENT SHARING

respective claims of invested savings, applied energies, and consumer interests, or—in more popular terms—of Capital, Labour, and State. All three are in the team. All three are partners.* No one can take an unfair privilege over the others without causing trouble and spoiling team play. The autocratic bureaucrat enthroned is stagnation, autocratic capital enthroned is slavery, autocratic labour enthroned would be red ruin and chaos.

British industry, then, wants neither capitalist king, labour kaiser, nor bureaucratic emperor. The world drift of industry is toward democratic control. The Wilhelms must abdicate. King Capital recognises that fact. Emperor Bureaucrat is recognising it. Kaiser Labour must recognise it or we come a mucker.

Rule, discipline, and order we must have. And we can have it under industrial self-government. "The greatest good of the greatest number!" Not plutocratic profiteering. Nor Bolshevik plundering. "Government of the people, for the people, by the people." The will of the people the ultimate law of the partisan, be he Capital, Labour, or Bureaucrat! Square Deals and Fair Do's! That is the scheme and policy for the future.

A strenuous military crusade has been

SCIENTIFIC FACTORY MANAGEMENT

successfully waged for freedom. Men of all classes were repeatedly told they had "an equal stake in the country." If that means anything it means that all hard-working citizens, whatever their forbears, have a right to live in more equitable comfort and to give their children a more equal start in life. The age movement is towards greater individual freedom. Not irresponsible individualism, but reputable collectivism under proficient individuals. Not increased bribes to Labour to become the docile bondsmen of Capital or of State, but industrial self-government. Managers and workers, employers and employed, have here a joint problem to solve. Leaders and led there will always be, where two or more are gathered together.

Capital :
its risks
and
returns.

Because money has taken the place of old-time barter and the exchange of goods or services, all sorts of confusion have arisen about Capital and Labour. Yet there are some fundamentals we cannot dispute or afford to ignore.

Productive industry is a condition of modern existence. Its services have to be rewarded. Those who refrain from spending the whole of their reward on subsistence and enjoyment provide the means for further developing industry, for building and equipping new

CAPITAL AND LABOUR

factories, and for laying new railways and otherwise making it possible for two people to get a living where formerly only one could exist. In other words :

Both Capital and Labour are essential to productive industry. Neither likes working for little or nothing. Both want a living wage and something more. Both go where they can get more. Both suffer through strifes and strikes. Both should work in harmony. If Capital increases faster than industry can absorb it, its rate of remuneration falls. If Labour increases faster than industry absorbs it, its remuneration falls. Though the State may for a while artificially bolster up either.

If the miner brings no coal to the surface, he has nothing to exchange or no buying power. If the agriculturist, resembling the lily of the field, sows not neither does he spin, he has nothing to exchange. No corn—no coal ! No coal—no corn ! Cold, starvation, want !

Going back for a moment to the “good old days”—before money existed : when a family had to consider whether a coat of bearskin could be spared to exchange with a neighbouring family for a canoe, it was clear to both parties exactly how much each article meant in use, in labour, and in material. It was natural to look at things in that way when

SCIENTIFIC FACTORY MANAGEMENT

determining whether the desire for a canoe was worth the risk of getting one, two, or three bearskins, or whether the work of making the canoe could command one or more skins. In the last resort it depended on the market and individual requirements.

By translating all values into terms of money, we moderns get quicker exchanges, but lose touch with social and labour values. Is the street scavenger entitled to a half or a twentieth part of the reward of a medical consultant? How much coal ought a miner to hew before he can expect a tailor to make him a coat? How many coats ought the tailor to make before he can expect the cloth-maker to employ a sailor to bring him wool from the Antipodes and to pay a carrier for bringing it from the docks, etc. Such transactions are clearly easier and quicker when the services involved are measured in terms of a common barter medium. In fact, without it modern commerce and large scale production would be impossible (63).

Then again, all intelligent and industrious people rightly expect a good day's work to provide something more than bare necessities, some articles or services that make for the comfort, dignity, and enjoyment of life. Under a monetary system, those of us who are thrifty

SAVING AND SPENDING

or ambitious can allow part of our marginal rewards to accumulate in token until such time as we want to avail ourselves of them : or until we are prepared to join with some co-adventurers in sending to a foreign country for special machinery or materials that will enable our community to turn out twice as many articles for exchange, as we did previously, or as does a similar group of men who elected to spend their rewards immediately they are entitled to it.

But whether we are capitalists or workers, we should all of us be chary of risking our accumulated savings in another such venture if our machinery were confiscated or our savings otherwise dissipated. We should either give up saving and stagnate commercially, or we should transfer our savings to some more favourable locality. For men naturally dislike risking their capital in something not likely to bring them an adequate return or to permit of their recovering the principal when they so desire.

Yes, but what has all this to do with factory management or the functions of workers ? Just this, Labour should realise more fully its own stake in industry and the dependence of industry on capital. Only by more developed production and by far greater output

SCIENTIFIC FACTORY MANAGEMENT

can the civilised peoples generally have more of the good things of this world. It is impossible to escape facts. The longer they are burked the more crushing the crash when the crash comes.

Take an article like cotton. To-day it is exchanged at an international price, and that country with the lowest costs of production, supplemented by satisfactory service, has the best market for its wares and most employment for its people. Or coal: pushing up its price will hasten the day of its replacement by other heat-producing agencies. These are hard facts.

Labour roundly abuses Capital, but shirks risking its accumulated capital in industrial enterprise. I hold no brief for the present distribution of capital. Both Capital and Labour must face the facts. Formerly, the person owning capital could use it as he liked—except in levying war on the sovereign or committing crime; but gradually we are coming to the view that, while the nominal ownership and detailed administration of industrial enterprise should be left to individuals, the making and marketing of products shall further the well-being and efficiency of the community as a whole, rather than the profits and self-satisfaction of “the owners.” Not only efficiency,

COMPANY SPIRIT

but also individual prosperity must suffer if the present misguided enmity between Capital and Labour is not replaced by a knowledge of their mutual needs, an appreciation of mutual interests, and a desire for mutual success.

The main thing is production—output—the ^{Company spirit.} successful issue of the joint enterprise. If Capital thinks of profits only, or if Labour thinks of wages only, both ride for a fall.

There must be the corporate spirit if either are to prosper. Siberia has rich natural resources and plenty of labour but hardly any wealth. Labour left to its own devices starves midst plenty. Labour linked with management and backed by Capital prospers like a green bay tree.

But everything depends on that link. It must be the bond of fellowship—not the bond of slavery: the tie of good feeling—not the clinch of enmity.

No regiment prospers and comes through the battle's ordeal with flying colours unless held together by a strong *esprit-de-corps*. Officers and men must have a proper respect for each other and a pride in their joint efforts.

Similarly no factory, no human enterprise, can thrive and come through life's struggles with satisfaction unless its human units are held together by a strong company spirit.

SCIENTIFIC FACTORY MANAGEMENT

Managers and workers must have a proper regard for each other and a pride in their joint product.

They are co-adventurers in a corporate task. And we all know what happens to a house divided against itself.

Unfortunately industry has not paid nearly sufficient attention to this great question of "company spirit." Yet it is a matter of supreme importance to manager and worker alike, or rather to capital, manager, and worker alike.

No man or woman finds much satisfaction in perpetual strife. The young and hasty may love a fight, the hale and hearty a keen competition, but both prefer harmony to discord.

In the field of sports we Britishers love a clean game—no hitting below the belt, no off-sides, no foul tackling. We cheer the team that wins on straight skilful combination.

Why not have it in industry? Why not fix the rules and play the game? See that the right men play centre forward, and that the referee's whistle stops fouls and off-sides. It is a matter of right education, sifting the facts and getting together! Mass meetings, joint gatherings, house bulletins, and the cheery spirit that fosters team play.

CULTIVATING CHEERFULNESS

As Benjamin Kidd has pointed out (45), human society is progressively developing two opposing but complementary tendencies: the one requiring increasing subordination of the individual to society, and the other causing the individual to challenge the authority requiring his submission to a process of social order in which he feels his own interest is small and those of unborn generations so great.

At the moment the challenging tendency is dangerously in the ascendant and the other wants boosting. Old Adam Bede rightly "dis-trusted that sort of learning as leaves folks foolish and unreasonable about business."

It matters not in what sphere of life we are ^{Wrinkle}workers, we have to-day to jettison prejudice ^{for} and take on board a cargo of cheerful common sense.

For, as Ruskin has reminded us, cheerfulness is as natural to the heart of man in strong health as colour to his cheek; and whenever there is habitual gloom, there must be either bad air, unwholesome food, improperly served labour, or erring habits of life.

Wondrous, is cheerfulness, wrote Carlyle, altogeth'er past calculation its powers of endurance. So he praised the man who sang at his work, holding he would do more, do it better and persevere longer than the gloomy

SCIENTIFIC FACTORY MANAGEMENT

man. Man is scarcely aware of fatigue as he marches to band or song. Even the horse reacts to sleigh bells.

Old Dr. Johnson was surely right when he said a man should spend part of his time with laughers—to cultivate the pleasure grounds as well as the cornfields of the mind.

If I have overstressed this point it is because I feel that every one associated in modern industry wants more of what Helen Hunt so aptly termed “a genius for affection.” A desire to create pleasure and diffuse good cheer played no small part in John Wanamaker’s remarkable career.

Indeed, one of the greatest mistakes of life is to save our smiles and pleasant words and sympathy for those of our set, or for those not with us, or for other times than the present (57).

Another is to go through life satisfied with our present store of knowledge of this most wonderful if at times apparently most cruel of worlds. Ignorance and prejudice are continually blinding the best of us—and no one more than the accredited expert, be he craftsman or brainsman.

This old world of ours keeps turning over the s’ods of knowledge that he who *notices* and *compares* can always find something new and valuable. We may quarrel with it and

INFLUENCE OF THOUGHTS

abuse it, but it is largely what we human beings make it by our outlook and attitude of mind.

“Learn,” said that wonderful old man known the civilised world over as “Root, the Bee Man.” “That’s the great thing. Learn all about your business, just as I did about bees.

“Be thorough. Get knowledge, because knowledge raises the quality, and quality ensures success.

“Don’t be afraid to try new things. Avoid a rut as you would the pestilence.

“You will make mistakes, and you will lose money at times; but you will make discoveries that will more than make up for your losses.”

Men are not influenced by things, but by their thoughts on things.

Labour wants shorter hours and less arduous toil. Labour is right, says Lord Leverhulme, but will never achieve its object by fight or might—only by skill and efficiency, by use of mechanical utilities and producing more goods in less hours.

Labour wants higher wages. Again Labour is right, but will only achieve its object by improved service for the consumer and reduced cost of product.

SCIENTIFIC FACTORY MANAGEMENT

Labour wants cheaper costs of living, cheaper houses, clothes, boots, shoes, food, and all the thousand and one items that form the necessities, comforts, luxuries, and elegancies of life. It will not get them by "ca' canny" restriction of output.

Labour wants a proper place in the management of the undertakings and businesses in which it is employed. Again Labour is right, says Leverhulme, but it will never achieve that object by fight or might, or by distrust and thwarting of Capital and employer, or by any other means than preparation for benefit of themselves and others, study of the duties of directors and the principles that have made for success and prosperity in the past (54).

It is, in fact, right up to each one of us to become personally more efficient—more competent—more conscientious—and more likeable.

SUMMARY

Or, summarising, we may conclude :

1. That as Workers we all have to learn and do.
2. That the most fruitful opening for self-training lies in the cultivation of right work habits.
3. That those motions which serve no useful

TWO EARS OF CORN

purpose must be found and eliminated and new ones of sound purpose discovered and introduced.

4. That ignorant individuals are a menace to their fellows and a drag on society.
5. That the interests of the community demand a square deal between Capital and Labour.
6. That industry is primarily a national service.
7. That each one of us has to strive to make two ears of corn grow where formerly only one grew.

CHAPTER V

THE FACTORY MANAGER OF TO-MORROW

“ **W**HAT is the most vitally important requirement of British industry at the present time ? ” (Appendix II.).

Is it Money ? Is it Organisation ? Is it Management ? Is it State Help ? Or is it Health ? Men ? Brains ? Raw Materials ? Honesty ? Courage ? Or some other human quality ? Let us pin it down and take steps to cultivate it.

Do you remember H. G. Wells' opinion, that the human mind has always accomplished progress by its construction of Utopias ? Yet so far in the world's history no one has described a business Utopia. Here is an opening for a book that would live down the ages ! Were I a rich man I would deliberately scheme to help my country and my age by offering a £10,000 prize for the best book on an Industrial Utopia. It would be productive of more good than the endowment of any half-dozen churches, and bring greater fame than any half-dozen honours Lloyd George or the King

KEENER, IMAGINATION

could confer. It would set a practical ideal before the world, a standard by which industrial efforts could be judged, an industrial Colonel Bogey for every factory.

Further, it would stimulate what to my mind is the most urgent need of British industry—IMAGINATION. That is my answer to our opening question. If we had more imagination we should soon have better organisation, more efficient management, fewer square pegs in round holes, more highly trained brains, a healthier and more contented people.

If only British industry had a keener imagination, we should just romp ahead as a happy industrial nation. We have the geographical position, we have an honest and industrious people, and just now we have an excellent world position. No other nation in the world has so favourable a strategic position. But unfortunately as a race we make an idol of practice and a doormat of principles. We don't fancy theories until others have tried them out. We are so confoundedly conservative. Why? Because we are so complacently ignorant! Why, again? Because we have so little imagination and do so little to cultivate it!

Kamerad! I am myself too matter-of-fact to write a book on a Factory Utopia. But I

SCIENTIFIC FACTORY MANAGEMENT

have lately been digging spurs into my imagination in an endeavour to visualise the task before post-war factory managers.

Victory is a big thing : its fruits have to be looked at in a big way. Industry is a big thing : and its activities need viewing in a big way. Industrial Management is a big thing : its responsibilities must be regarded in a big way. The average business man, steeped in complicated routine and smothered under multifarious details, has hitherto found little time and felt too little inclination to study these activities or to examine their responsibilities very closely. When they have been considered it has been much more from the viewpoint of the efficient individual than of an efficient community.

In fact, from time immemorial the dominant theme of the Western mind has been everywhere the same—the activities of the individual for his own interests ! (56). But the war has been a great awakener of ideas, a great blender of ideals and a consolidator of men. Most of us are now at long last beginning to have an inkling that internationally the welfare of humanity must take precedence over the selfish aspirations of any one nation, and that industrially the welfare of the group must take preference over the greedy gain of the individual.

THE NEW ERA

We are on the verge of a new era of civilisation ; and the goal to which the face of civilisation is turned is no longer the efficient individual but efficient society ; not individual integration but social integration (44) ; not one-man proprietaries but big industrial units.

A. PROFESSIONAL OUTLOOK

That being the situation the after-war factory manager has to face, he cannot too closely examine his position. A time of transition is always the most difficult. It is also the time of greatest opportunities. It is then when men of enterprise rise to full power. Alexander, Napoleon, Washington, Rockefeller, Carnegie, were all men of change. The organisations each controlled were very different when they had done with them (25).

An industrial strategist.

Modern business is a maze of complex details, a criss-cross tangle that wants unravelling. Its present practices are the results of years of accumulated experience and observation, but many of them are obsolete and want cutting out. No man ever reaches a responsible position without formulating certain general truths, which he believes fundamental to the conduct of his enterprise. Sometimes these are embodied in apt precepts like Marshal Field's "The customer is always right."

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Such precepts or pet phrases are only broadly true and applicable in a mere mechanical way. They need to be collected, sorted, and sifted for the winnowing of fundamental principles.

Management everywhere will have to take a keener professional interest in work of this kind (67). It must aim at establishing a scientific analysis of functions and grouping activities accordingly (16). It must view these activities in their right perspective. For there is a mutual interdependence of all business activities, and a balance must be maintained between them (66). The distribution policy must balance with the production policy, the purchasing with the selling, operation with design, inspection with standards, etc., and *vice versa*.

It is this balancing of interdepartmental activities that is the big- or little-unit manager's real task. His the job to regulate and co-ordinate group activities: otherwise his business will be out of adjustment. Actually most businesses are out of adjustment to-day, because few present-day managers maintain a proper balance between group activities! How often does the sales department appeal on quality and service while the factory is trimming costs with small regard for quality—to name but one common failing.

THE STRATEGY OF MANAGEMENT

Nor is this lack of adjustment and balance surprising when we remember that few business men are free from departmental bias—usually in favour of the departments in which they earned their spurs. No manager of a big concern should regularly concentrate on a particular department. If his concern is such that he must himself run a department, he should cultivate the habit of regularly withdrawing to a position where he can exercise a detached supervision over all departments. For a manager is properly a strategist co-ordinating and regulating the activities of others.

That is to say: The after-war factory manager must clearly have—

- a more conscious professional outlook—and a definite professional pride;
- a keener recognition of his own strategic position as a unifier of activities;
- a greater appreciation of exact definitions and correct principles.

Admini-
strator
rather
than
materials
tech-
nician.

Now please, don't dismiss this as a doctrine of impossible perfection. The day of rough and ready methods in industry is waning. Henceforth we must use ever keener and more accurate weapons. Competitive struggles, like modern fleet actions, will be carried on at

SCIENTIFIC FACTORY MANAGEMENT

longer ranges and against more highly trained antagonists. The day of rule-of-thumb is not yet ended, but its sun is setting. Many managers manage as their predecessors managed of yore. Their motto is "Hustle and drive." They are "doers." The slogan of the future manager will be "Think and do."

Why was it, Ruskin once asked, that industry was held in less esteem than other professions, such as that of the soldier, the doctor, the pastor. His own answer was that, while the other professions sought to do good to other people, industry was primarily self-seeking. It is not that considerations of individual profit must be eliminated, but rather that its importance must not be over-estimated in relation to the other factors in organised society.

As W. L. Hichens (59, 80) of Cammel Laird's has of late so cogently emphasised, also Samuel Turner (58) and others almost equally prominent, industry is a national service, and it is of vital importance that this aspect of it should be brought to the fore, and kept there.

The war has admittedly done much to weld us together into an organic whole with our individual and collective rights and duties more clearly defined. But in the industrial sphere the process of definition has not gone far. We

THE SPIRIT OF THE SCIENTIST

might say it is only just beginning. To neglect it will be rank folly. Every closer definition we get of the rights and duties of employers, employees, and consumers makes for better understanding. It is ignorant perversity that fosters trouble.

Industry needs more of the spirit as well as the methods of the scientist. The latter's stepping-stones to the bank of new knowledge are definitions, principles, and laws (not legislative enactments, but well-founded consolidated principles). Consequently I for one am glad to see places like the Manchester College of Technology taking the bold step of starting Departments of Industrial Administration. Industry should whole-heartedly support such developments and eventually look to them as the chief formulators of industrial definitions and those economic principles that will one day find embodiment in a science of Industrial Administration.

I for one shall be delighted to hear that some one in such a department has formulated a better definition of a manager than the one I put forward: a strategist co-ordinating and regulating the activities of others. As such, a manager is much more an administrator than a materials technician. Carnegie was not trained as a steel technician, nor Rockefeller

SCIENTIFIC FACTORY MANAGEMENT

as an oil expert, nor Rhondda a food expert, nor Eric Geddes a sailor, nor Leverhulme a soap expert. They were one and all especially able administrators with strong personalities.

A consistent student.

What, then, is the moral to be drawn? Is it not that the larger the industrial unit, the more important becomes the administrative capacity of the manager and the less important his skill as a handler of materials. I can well believe there will be readier agreement with the converse of this deduction, viz. that the smaller the industrial unit, the less important a manager's administrative capacity and the more important his skill as a materials technician.

In the smaller concerns the regulating of sectional groups and the co-ordination of their activities is comparatively easy. They are short range propositions. Their interdependence is readily seen and their activities balanced by verbal instructions. In fact, it is when decisions have to be taken on recorded results and communicated in writing that the importance of administrative capacity in handling affairs outweighs technical skill in handling materials.

While the circumstances of many factories may cause managers to be concerned primarily

ADMINISTRATIVE TECHNIQUE

with operations, the other functions clearly cannot be ignored. The varying relative importance of administrative capacity to material technique can perhaps be best shown by some such diagram as the following :—

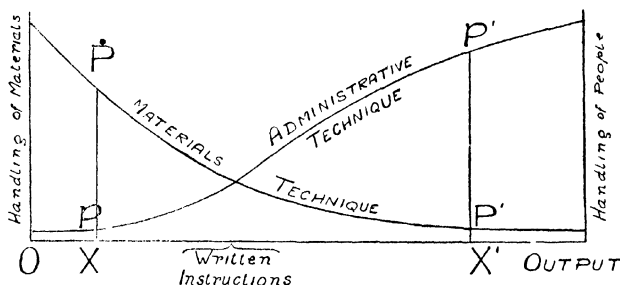


FIG. 5.

Where at a point X the ratio of Materials Management or Technique to People Management or Administrative Technique is as $PX : pX$. These are of equal importance at the intersection of the curves or round about the stage when written instructions become necessary. When the output is very large, as at X' , Administrative Technique is of greater importance than the Materials Technique.

I am not arguing that successful managers of small concerns need no administrative skill. They do—but of a more elemental kind than for a big concern. Similarly, leadership qualities are of a more primitive type. How,

SCIENTIFIC FACTORY MANAGEMENT

then, is a naturally good leader in a small factory to raise the standard of his administrative skill ?

Let us look at other professions. How does a lawyer, an architect, an accountant, or any other professional man raise the standard of his professional knowledge ? Is it not by definite and arduous training, by professional conferences, and above all by consistent reading of professional literature—in short, by study ?

Who are the two most outstanding men in the world of to-day ? Are they not Marshal Foch and President Wilson ? Neither of them has shone by reason of the knowledge with which he was born, but rather by their skilful use of the knowledge they have acquired—after years of close study. If they in their time had not been close students of their adopted professions, what would civilisation not have lost ?

Therefore I say without the slightest hesitation that the successful after-war factory manager must and will be a firm believer in consistent study—in his early years of materials, in his middle years of people, and in his later years of philosophy. Further, many of them will write books on some phase of industrial management and serve on professional associations.

CONSTITUTIONAL METHODS

Nor do I think I have placed too high an ideal before future factory managers. The sooner we see it realised, the better for all parties, whether Capital or Labour, whether nation or individual.

Advocate
of consti-
tutional
methods.

One of the first steps I would suggest is the formation of a professional association. It is a step that follows every conscious recognition of what I may call professional responsibilities under other than autocratic control. Medical men, dentists, engineers, lawyers, accountants, secretaries, etc. etc., each have their professional associations. Soldiers, sailors, and the clergy have uniforms and clubs—because they are more autocratically governed! Though even here there are signs of a more democratic future, the Church electing its Bishops, and sailors and soldiers having Committees.

When this professional association of managers does come—and there is no reason why it should not come as a peace reconstruction scheme—I hope a qualifying adjective will be introduced in the title. It would act both as a slogan and an ideal, if, for instance, the new association were styled The Institute of *Efficient* Managers. In short, it would be a modern Order of Good Templars! The annual membership subscription to such an Institute should be paid by the employing firm,

SCIENTIFIC FACTORY MANAGEMENT

and the proceeds be spent in developing the Science of Industrial Administration and State Institutes for managers and foremen.

Whether this is Utopian or not, I guess it requires little wit to see what an immense power for good such a body would possess and wield. Indeed, I will go so far as to say it would largely eliminate Capital and Labour misunderstandings. No other body of men would be in a better position to do it. Managers can, however, only hope to do it corporately. In a corporate capacity they could, for instance, if they wished, "court-martial" their members in any factory that had a strike and promulgate their findings as to the defaults of Capital, Management, or Labour.

Another advantage that would flow from such an Institute—and one towards which we shall find factory managers tending before such an Institute can possibly come into existence—is the promotion of "constitutional" management. Just as no Government, no Army, and, in fact, no large corporation can function without a body of rules to regulate its procedure and to guide its individual members (74), so sooner or later we shall recognise that every large factory must have its own manual or constitution to regulate internal and external personal relationships. Some

BEHIND THE BALANCE-SHEET

factories have already a "Book of the Plant."

We often scoff at Government red tape—sometimes, though not always, with reason. During the past four years the civil servant has taught business men a lot, and the business man has returned the compliment by teaching civil servants something. Doubtless, the civil service is over-controlled, but business is under-controlled.

Reor-
ganisa-
tion from
the top.

Civil servants must leave nothing to chance, for fear their parliamentary chiefs may at any time have to answer some question on pettifogging detail as to why Mrs. M'Ginty's pig died or how much horse-power T.B.D. *Swallow* develops. They are consequently at times exasperatingly pedantic in getting written records and filing them where they can be found. Whereas practical business people, not having to supply outsiders with detailed information, have been woefully lax in the matter of records. Plenty of manufacturers cannot tell you off-hand what horse-power their own works use. And what is more, they probably have no proper records of their plant; or if they have, they can't be found when wanted.

Indeed, the outside world has little idea how haphazardly most businesses are run and

SCIENTIFIC FACTORY MANAGEMENT

what a mass of mistakes the average balance-sheet covers. So it decries the civil servant, who is not allowed to answer back, and lauds the manufacturer, who gets a much bigger reward for more slipshod work.

Oh yes, I know it is usually put the other way round. The practical man "gets there"—but so often with an utter disregard for the consequences to other people, that he has brought the whole capitalistic system into disrepute. Nor would this have happened if the many fair-minded capitalists had seen to it that managers generally were corporately organised.

But whether or not managers are so incorporated, it is certain that in the next year or so many of them will have to face reorganisations in the factory. For such matters they can learn a lot from Civil Service methods, and more still from the methods of the scientist.

When the scientist tackles a new investigation, he invariably endeavours to ascertain all the known facts first. These will be carefully classified and even reconfirmed before fresh experimental work is undertaken. Nor will the main problem be seriously tackled until available competent counsel has been consulted and a general plan of attack outlined.

REORGANISATION POLICIES

The average man's idea of reorganisation is concentrated pressure on the weakest spot—too often wrongly thought to be at the bottom! Whereas the only satisfactory way of attempting reorganisation is with a definite plan and as far as possible from the top downwards. Admittedly improvements at the bottom immediately affect the greatest number of people and bring forth multifold fruit; on the other hand, improvements at the top facilitate growth and richer harvests.

B. GUIDING IDEALS

But, whether for reorganisation or for normal progress, the professional manager of the future will lose no opportunity of developing his subordinates. For not only must he manage by and through them, but he must have men in training for promotion if bigger scale work is to be attempted. From his own experience and from that of other similarly placed men, he will know how on the one hand specialised work tends to limit outlook, and how on the other progressive men must repeatedly assume responsibilities for which they have had no specialised training. If, therefore, they are to be safely entrusted with big interests, they must first have regular opportunities for developing and disclosing their powers of

SCIENTIFIC FACTORY MANAGEMENT

judgment concerning men and materials, situations and policies.

The price of iron ore is only a few pence per pound, of carbon steel some shillings, but high speed steel runs into hundreds of pounds. In short, intrinsic value increases faster than cost. The same is true of human beings. In other words, it pays every time to train the right people. The trouble is in the word "right." As Harrington Emerson has said, the right person in the right place is no easy job ; it is the biggest problem there is.

But why should we be so casual about people ? We don't take chances with materials. To-day the average factory manager spends at least nine-tenths of his time worrying about materials, and less than a tenth worrying about people ? He buys or has elaborate instruments devised for testing materials, but uses the most empirical ways of selecting people. A beginning of reform has, however, been made by appointing employment managers—though as yet they are often but very poorly qualified for their work.

Significantly, the American War Industries Board, made a distinguished writer on Industrial Administration (7) — Professor E. D. Jones of Michigan University — Director of their Employment Management Division, and

TEST OF BUSINESS GREATNESS

arranged for special six to eight weeks' Emergency War Courses in Employment Management to be given at some dozen Universities and Colleges—No Tuition Fee! When will we, British have the courage to imitate them, and to go one better by appointing applied psychologists to our factories, as we now in a very restricted way appoint applied chemists?

The real test of business greatness is in giving opportunity to others — Charles M. Schwab's dictum. The big corporations are realising that their success in the future depends on the right training of the young men in their organisations.

Given the right men in the right places as a foundation, we can, as Emerson has suggested, joyfully fortify them with ideals, with common sense, with competent counsel, with discipline, with the fair deal, with efficiency rewards; we can go ahead with plans, with schedules, with despatching; we can standardise conditions, operations, and instructions; we can check anything with reliable, immediate, and adequate records, and with any other principles, methods, or devices that experience warrants.

Then will the factory manager find the truth of our definition that he is a strategist whose task is the co-ordination and regulation of other people's activities; and that his two

SCIENTIFIC FACTORY MANAGEMENT

guiding principles must be the Principle of Interdependence and the Principle of Balance (66).

Naturally enough, his specialists will at times be prone to magnify the relative importances of their own respective spheres. While this is a very human weakness, it is also a source of great commercial strength. It spurs on the healthy-minded individual to break fresh ground. Consequently, great tact is demanded of the manager who essays to check this type of ardour with the object of keeping the activities of his plant adjusted and balanced. Yet at times he must, for he above all others is responsible for maintaining right relations between opposing activities. Indeed, he may purposely, by team play and emulation schemes, have set them in competition for efficiency results. But all the time he must see that right relations are maintained, and that everybody pulls the same way and not tangentially. There is healthy rivalry between football teams, without any spoiling of feelings and relations; and, after all, why not between factory specialists and sections ?

Time for
thought.

Of all the people in industry, then, who should have time for thought and sensing problems ahead, a factory manager comes an easy first. But how often does he get it ?

FREEDOM FROM ROUTINE

Partly because he is primarily a materials technician, and partly because he considers "example better than precept" an exact fully-rounded truth, he slaves like a horse and works harder at detail than any one else. It is bad tactics, to say the least of it. The harder he works on routine, the less can he stimulate and regulate the work of his subordinates.

For, remember, he is there to adjust and balance their activities, and to prepare for the problems ahead. When he is doing anything else, other than walking round and lubricating the plant by cheery words, he is not managing.

No one in the whole plant is more responsible for correct principles being known and followed. But he cannot develop his grip of principles and the best way of applying them if he allows himself to be snowed under with routine. How often does one hear an overworked manager say his assistants are fools? Such a manager is only the holder of a courtesy title and not really an efficient manager.

The other day I picked up a copy of *Industrial Management* and came across some very sound managerial advice in the advert of an American efficiency expert. It ran something like this :

After the war the basis of reconstruction throughout the world will be Industry. The

SCIENTIFIC FACTORY MANAGEMENT

great world problems, present and future, are and will be industrial problems. Are you giving them real attention? Are you using correct principles?

To solve your problems, six steps are necessary :

1. Analyse your situation to determine present weakness.
2. Organise your industrial machinery to co-ordinate the various functions properly.
3. Plan and control all production activities to secure volume.
4. Provide simple but comprehensive records as a guide to cost reduction.
5. Standardise operations and working conditions to avoid waste in time and material.
6. Provide adequate incentives to induce co-operation and sustain interest.

Management by standards.

This, I am sure you will agree, is very sound counsel. Yet it is seldom followed—and for two reasons. Firstly, managers often zealously but quite wrongly allow themselves to get immersed in routine; and secondly, they don't know how to get out of it.

And, what is more, they never will until they determine to set themselves free for study and thought. That is axiomatic. Free to go and see other factories, to meet other managers, to attend lectures, to read modern

STANDARDISING MANAGEMENT

industrial literature, or books like Marshal Foch's *Principles of War*.¹

But how can they leave their plants when there is so much to be done? The answer is clear, if the means for giving effect to it are not. By standardising management and training subordinates to do most of their present work.

We have seen that F. W. Taylor pointed the way to standardising production by his system of scientific management. Many subsequent workers have slowly but surely improved upon his methods and communicated the results of their work. Harrington Emerson has so ably sifted and explained the underlying principles in *The Twelve Principles of Efficiency*, and G. H. Shepard, in *The Application of Efficiency Principles* (24), has told the world how to apply them in such a way, that no manager need long remain ignorant of the first principles of Efficient Production; while C. B. Thompson has made us all his debtor by collecting in one volume the more significant articles describing the Taylor system of management (17).

The next stage, which is only now being slowly evolved, is the standardisation of management by the gradual division of activities along functional lines and the institution of premium

¹ Translated by Hilaire Belloc (Chapman & Hall).

SCIENTIFIC FACTORY-MANAGEMENT

incentives for definite efficiency attainments. In other words, successful attempts are being made to set up generally recognised standards other than profits by which the efficiency of management may be measured. "

Elimina-
tion of
waste.

To what end is this intensive concentration on scientific management that has so gripped the American imagination and is now at last getting through our British conservatism ? It ought to have started here, and it would have done if we had had more imagination.

Is it not the elimination of waste, the dethroning of incompetency, and the crowning of efficiency ?

We have just finished one war. We have to get ready for another, and one that will demand the united efforts of the whole nation. I mean the war on Waste. It will come right into the factory. Lloyd George got it when he said that the war had pointed out to us, with its glaring, burning, scorching finger, the wasteful use to which we had put our national resources in men and material.

How often is the work so badly planned that idle machines are eating their heads off at rates from anything up to eight, ten, twenty, and more shillings per hour, and men standing by frittering away their most valuable asset, time, because there is no next job ready ?

ELIMINATING WASTE

How often is a heavy piece of work machined at a rapid and efficient rate only to be held up a quarter of an hour for an inefficient lifting tackle to be got into position ?

How often do people waste hours doing jobs by hand both in factory and in office when they might have done them in a fraction of the time by the use of mechanical devices ?

How often do foremen and others spend hours kicking their heels because they cannot get the ear of an overloaded manager ?

How often is a skilled worker made to exercise his limbs in needlessly ineffective motions because his equipment is badly arranged ?

How often are workers left to fatigue themselves needlessly because they have not been properly taught ? Fortunately, Prof. H. J. Spooner has pointedly drawn our attention to these enormous leakages in his recent book on *Waste*¹ (60).

As St. Elmo Lewis has so truly said (55): Service to the public. Business will sooner or later have to justify its management. It will have to sustain its claim to social support. It will have to show that its methods are most efficiently doing the work society requires of it.

¹ Lord Leverhulme's Introduction to this book deserves attention.

SCIENTIFIC FACTORY MANAGEMENT

For no business can gain its best end that serves only its shareholders' interests. It must serve the larger interests of the entire organisation, shareholders, employees, and the public at large.¹ This is the rule of common sense applied to business. It is, in fact, a moral obligation implied in the privilege to exist granted by society. Good service is the only thing for which man can long continue to receive a price.

This, then, is the ultimate and ideal purpose of all efficiency and of all the laws working towards this one end of success—the ideal of service.

Business men have created a huge machine for production and distribution. Society is

¹ From the public standpoint, the most serious defect of modern business is its selfish and almost prodigal disregard of community interests, particularly of succeeding generations. Under the free play of the motive of personal gain and its modern form of profit-making, as at present actuated, there are two almost inevitable failings:

- (a) A desire to extract the greatest possible profit for the present generation of shareholders, irrespective of possible adverse effects on the future community.
- (b) A reckless exhaustion of natural resources, both material and human, from the wasteful exploitation of coal to the callous using-up of human beings.

In a recent notable book, *The Foundations of National Prosperity: Studies in the Conservation of Permanent National Resources* (Macmillan), Professors Ely, Hess, Leith, and Carver contend that the community cannot safely entrust its principal resources to even the most enlightened capitalism. "The State alone can safeguard adequately the interests of the future."

STEWARDSHIP OF THE SUCCESSFUL

demanding that the machine as constructed shall have but one right to exist—that it shall give the maximum of service for the minimum of profit.

Nor must we forget that a tremendous privilege tax has to be paid by the men who pass onward and upward beyond their fellows. The successful man's reward is not all his own. As the ancient Egyptian said, he is but a steward. He can never enjoy the reward unless he gives much of it away. In the words of St. Elmo Lewis again, this is not sentimentality or mushy preaching. It is hard, cold, business-like law that is in operation. Greedy wealth makes greedy labour; blind plutocracy breeds blind syndicalism.

Envy and hatred are not natural born-in-the-heart attitudes of the masses. They are nurtured by controllable circumstances, by the greed of those who have had no training in the obligations of success.

Factory managers of the future must be humanitarians as well as industrial leaders. They must serve the public or expect trouble. "After me the deluge" is the rankest folly.

C. ADMINISTRATIVE TECHNIQUE

It may be urged that I am setting far too ^{System-}high an ideal for a practical commercial factory ^{atic} approach.

SCIENTIFIC FACTORY MANAGEMENT

manager. Don't make any mistake. It is a case of voluntary collectivist action or compulsory collectivist action. Of industry arranging its business creed on higher social ideals and compelling its unsocial units to adopt the same, or of society imposing drastic and punitive regulations. As Winston Churchill said in Manchester last autumn: The times in which we live are too serious for flattering illusions. The after-war factory manager cannot have too high a standard.

The new era of civilisation upon which we are entering will be actuated by the emotion of strong ideals and not those of cold reason. Germany divined the secret less than two generations ago. Perhaps fortunately for us, she misapplied the enormous power it placed in her hands by her unadulterated Marxian conception of the State. But undoubtedly it was the idealisation of the German nation, inculcated in her schools, that caused millions of her sons to face almost certain death in repeated mass formations.

We, in the last four years, have seen this same power in operation among our own country's sons and daughters. Though, happily for us, with a more spiritual bias. The emotion of the Strong Ideal is the secret of the new-born power of Japan. It has been

THE SYSTEMATIC APPROACH

the strength of the Roman Catholic Church. We can get it into British industry if we will but cultivate "company spirit." To that end we shall need thoroughly able factory managers—managers who like men as nurses like children.

The first step is the inculcation of a fresh point of view. Indeed, the adoption of a new point of view was the starting-point in the development of the Taylor system of shop management. If scientific management means anything, it means an entire divorce from tradition. It may be nothing but applied common sense, as some of its critics have said, but it is based on a systematic approach to industrial problems, namely :

1. Elimination of the personal equation.
2. Separation of the problem into constituent parts.
3. Listing of the factors involved.
4. Taking a new point of view.

This is the method of approach that should be applied to all after-war problems, and one that A. W. Shaw, the Harvard University lecturer, has ably discussed in its application to business problems generally (66).

Applied common sense. Yes ! But instead of the process being haphazard and unconscious, the approach is systematic and conscious. Watch-ful of symptomatic details.

SCIENTIFIC FACTORY MANAGEMENT

And that makes all the difference in the world. It drives home the fact that the manager should be the critic-in-chief of his organisation. Either silently to himself or aloud to others he must "why" this and "why" that.

Successful management demands an analytical mind. Calm, deliberate analysis is a factor ever growing in importance: to it must be added imagination, judgment, courage, and executive ability. Most people may consider executive ability the most important. Prof. Taussig suggests it is less rare than the combination of judgment with imagination (41).

Let us now put this manager of our big after-war factory at arm's length and have a look at him. War lessons have aroused in him a keener professional outlook than his predecessors possessed. Contact with soldiers and sailors, knowledge of their heroic deeds and self-sacrifice, have made him want to function more as a skilled company officer or naval commander, namely, as a student of his calling, a leader of his men, and a server of his country. In short, he has bigger ideals. He recognises that as an industrial administrator he is primarily a regulator of other people's activities, and that as such he must keep constantly in mind the vital principles of interdependence

SYMPTOMATIC DETAILS

and balance. That, in point of fact, he must have a definite administrative technique.

Of this administrative technique we have already noticed several well-marked phases, when considering questions of outlook and ideals. First and foremost perhaps is his systematic approach to industrial problems, including those of his own position, and therefore the necessity of finding time for thought, study, and analysing problems; the setting up of a more formal organisation; the conscious development of subordinates, etc. etc.

Clearly this cannot be done if he allows himself to be deeply immersed in routine. Yet he cannot neglect routine—for obvious reasons. Consequently he must keep in touch with it—without spending much time in the process! Right here is the crux of every manager's difficulties. Like any other problem, however, it yields to analysis.

Three points of contact must be established :

1. By periodical receipt of summary reports or records.
2. By periodical personal inspections.
3. By requiring submission of significant exceptions, the main object being to get hold of symptomatic details.

The importance of such symptomatic details

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is not to be measured by their size or the amounts involved. Apparent trifles may point like straws to significant improvements and even open up big managerial problems.

Only by keeping free from non-symptomatic details can a manager preserve a true perspective of the whole field and satisfactorily co-ordinate the various group activities of a big concern.

Related
groups of
functions.

No manager can of course occupy this strategic position—that is, be free from the routine of any department and yet in touch with the significant details of all—unless he has the courage and wit to delegate responsible duties to individual executives. This, after all, is only an extension to management of the division of labour. It is the four-thousand-year-old advice given to Moses by his father-in-law Jethro, and the policy followed by the developers of all big enterprises.

Every growing firm recognises it, though rarely according to a carefully thought-out scheme. More often than not an overworked manager gets an assistant, who gradually takes over a haphazard group of his chief's work, and later a further assistant takes another group, and so on. Result: No one in the concern really knows which of them will deal with a score or more questions that only

CLASSIFICATION BY FUNCTIONS

arise occasionally. The scheme of classification is bad—if indeed one can be said to exist at all.

Our professional manager, however, will not make that mistake. As his concern grows, he will delegate related groups or functions, according to a good classification (16). His studies and inquiries will have shown him a variety that may meet his present requirements. But I shall be agreeably surprised if any one can tell me at the present time of a better scheme than the following, based as it is in the main on Church's thoughtful analysis of the manufacturing problem (9).

It is a classification of industrial activities arranged on a plan analogous to the naturalist's classification of the animal kingdom, *e.g.* :

Kingdom . . .	Animal.	Business.
Sub-kingdom .	Vertebrata.	Industry.
Class	Mammalia.	Production.
Order	Carnivora.	Design.
Genus	Canis.	Standard.
Species . . .	Canis familiaris.	Court Shoe.
Variety. . . .	Irish Fox-terrier.	Albany Tab.

Unfortunately, English-speaking people use words so loosely, we cannot well consider "Business" and "Industry" exact economic

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counterparts of the zoological “animal” and “vertebrata” subdivisions. But, such refinements apart, the general analogy may be said to obtain :

CLASS.	ORDER OR FUNCTION.	GENUS.
PRODUCTION	Design	{ Design. Research. " Standards. Complaints.
	Equipment	{ Power, Light. Heat, Ventilation, etc. Building. Scrap.
	Operation	{ Operating departments.
FACILITATION	Comparison	{ Inspection. Testing. Efficiency. Cost-keeping. Storekeeping. Wage-recording. Statistics.
	Control	{ Organisation. Works orders. Progress. Employment. Purchasing.
	Finance	{ Accounts. Credits and collections. Audits.
DISTRIBUTION	Distribution	{ Publicity. Sales promotion. Customer letters. In-stock keeping.

Organi-
sation by
plan or
chart.

Though not by any means exhaustive, this analysis is a sound compromise. It embodies the main ideas of the best classifications yet published; it takes account of the natural

PAPER REPRESENTATIONS

lines of industrial growth ; it keeps related functions together. As a good classification, it allows the man using it to back away from his own little corner, or the things with which he is immediately occupied, so that he can the better survey in their true relations and proportions all, or nearly all, the activities involved. It helps him to unload by indicating the right quarter ; while it aids the ambitious subordinate to develop by indicating future possibilities.

According to the size and circumstances of the plant, sub-functions may be delegated separately or severally to particular individuals. They may be exercised in one building or in several—for sound business policy envisages many compromises. To-day, however, very few British factories pay nearly enough attention to the two facilitative functions, Comparison and Control. In fact, many factory officials won't even admit the possibility of their existence as profitable units and effective aids to big scale management. Their sons will—and maybe decry paternal short-sightedness !

The steady growth of big concerns and the necessity for co-ordinating and supervising their numerous resulting details is forcing management to deal more and more with paper representations of materials, motions, and the

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relations involved, instead of directly with the things themselves.

For their quicker handling and the avoidance of errors, diagrams and charts are being forced to the front. Prominent among them is the Organisation Chart representing individual responsibilities. Hitherto such charts have been very largely empirical—that is, without any well-founded analytical basis. In more ways than one they have been as accidental as the genealogical trees they so closely represent.

But let us briefly analyse the problem of compiling an organisation chart. We have persons responsible for subdivisions of the corporate task. That is, we have two variables only. These two elements are persons and work. Here then is an easy charting proposition. We have only to mark off the people-subdivisions along one side of a rectangular piece of paper, and then work-subdivisions along an adjoining side, to be in a position to draw lines that must embrace each person's work and each piece-of-work's person—if I may use such a term!

Sub-
division
by
functions:
Model
Chart.

Working on these lines we get a model organisation blank containing spaces for the insertion of the appropriate person-task or task-person designation, *e.g.* operation super-

SCIENTIFIC ORGANISATION

intendent, cost-keeper, etc. Many designations in common usage are perhaps not at first sight so doubly descriptive of the task and the person, *e.g.* treasurer, chemist, etc.—though, of course, a buyer is one who buys, etc.

On the following page is such a blank showing main divisions only (see Fig. 6).

It will be noticed that “Operation” is the “Line” function, while the other functions are “Staff” subdivisions in the more popularised “Line-and-Staff” form of managerial organisation.

If the executive personnel are styled Foremen, 1E is the Design Foreman, etc. If the determinative personnel are styled Directors, 7D is the Director in charge of Distribution, etc.

Following this further, and inserting subdivisions of the main functions and personnel, we readily get a more scientific organisation chart than any I have hitherto seen (Appendix IV.). But I am under no delusion that every big manufacturer in this country will rush in and use it. Indeed, I am told it is fifty years ahead of British manufacturers. Though I hope not, for I am confident that it will be taken up by American manufacturers, and expanded or adapted to suit their requirements.

	1	2	3	4	5	6	7	
Consultative								C
Determinative							7D	D
Administrative								A
Executive	1E							E
Operative								O
	Design	Operation	Equipment	Comparison	Control	Finance	Distribution	

FIG. 6.

ORGANISATIONAL SERVICES

In brief explanation before passing on, I might add that its underlying conception (p. 25) presupposes the whole organisation to be a group of specialist services. For example, departmental inspectors and cost clerks are members of the "Comparison" service, the one on the inspection side and the other on the accounting side. And just as an Army dental officer, for instance, will be serving in a military camp at Brocton, where he is subject to the General Officer Commanding for matters of camp discipline, but to his own service superior officer at York for professional matters, so the junior cost clerk working in a factory department should, in my opinion, conform to departmental discipline, but be responsible to a senior cost-keeper for his cost work.

To people experienced only in small works this will appear at first sight an unnecessary refinement. But what actually is the generally recognised relation between departmental head, cost clerk, and the head of the costing department?

As a matter of fact, it is precisely one of those definitions of responsibility that present-day industry shirks and consequently lacks—to the detriment of its constituent factories. For in such matters there is to-day no standard

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practice or generally accepted principle! As the result of the prevailing spirit of expediency, it is true, there is a variety of compromises. They work up to a point, but they don't make for easy expansion.

In case any reader should consider the main chart only suitable for large concerns, I give (Fig. 7) an illustration of its applicability to an organisation employing seven persons in addition to its "productive" labour force. Not that I suggest there is actually much virtue in so small an establishment having an organisation chart, seeing that it has hardly got beyond the "Tom-tell-Dick" stage—unless it be as a guide for expansion.

This chart exemplifies the general applicability of the suggested classification and its suitability for both small and large factories.

Organi-
sation v.
personal
super-
vision.

But whatever form of organisation chart the future factory manager adopts—and if his factory is of any size he will most certainly have a comprehensive one for the whole plant and more detailed charts for his various departments or functions—a comprehensive organisation chart will become more and more recognised as the first step in the scientific administration of large industrial units.

Nor can it be too strongly emphasised that a carefully worked-out organisation chart

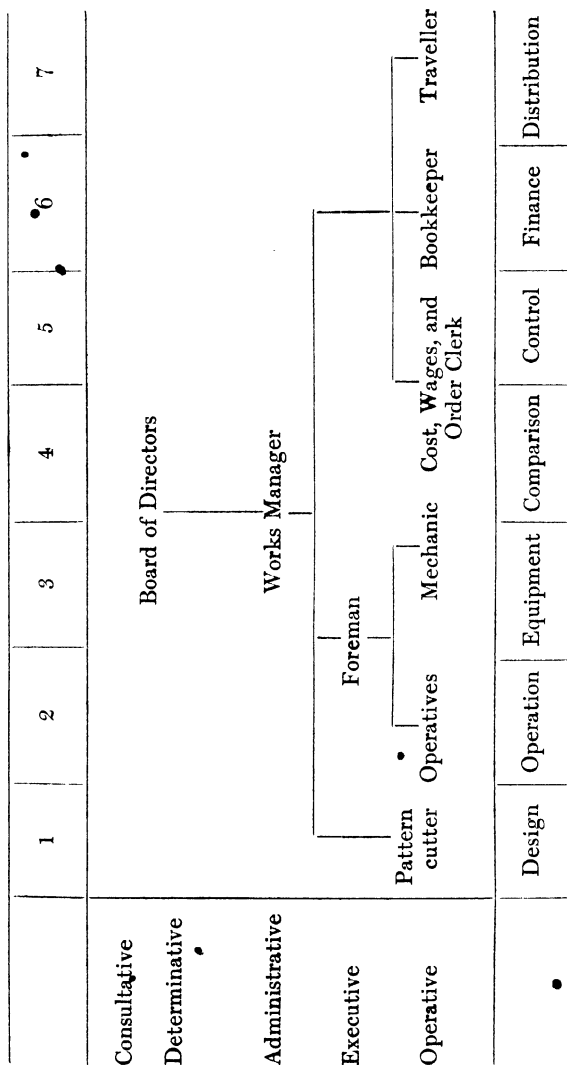


FIG. 7.

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visualises the inter-relations of an organisation better than any narrative account. Moreover, it not only prevents the overlapping of work by various departments, but automatically guards against misunderstandings, of policy or confusion regarding authority and evasion through ignorance. Further, it is properly the first stage in the preparation of those factory manuals (p. 101) that will form almost indispensable features of the future manager's working kit.

For specialised organisation must increasingly take the place of the manager's personal supervision in industry, just as it has done in civil, military, and naval services. Indeed, industry would benefit considerably were manufacturers to have occasional lectures on naval and military organisation by some of our leading admirals and generals, or to study their service regulations. Just think what inspiring addresses Marshal Foch or Sir David Beatty could give !

In this connection we may well glance at the plan followed by Napoleon (25). His mind worked with great and rare precision, but it is generally believed that his tremendous accomplishments were more the result of incessant energy, directed according to an excellent method, than to any mysterious mental process.

HANDLING OF COMMITTEES

For the better conduct of his campaigns he created a vast news-gathering organisation. To reduce the material to a usable form he developed a regular statistical bureau, with secretaries to draw up summary statements and prepare maps. When he halted from the march his study was at once installed. On the best map of the seat of war, the rivers, mountains, frontiers, army positions, were all clearly indicated by pins with coloured heads before Napoleon entered. In this graphic way he rapidly acquainted himself with essentials. In short, Napoleon saw to it that his judgment was pretty solidly supported by facts. He faced the facts, keeping leading places and principles in mind and getting details boiled down by subordinates.

Another feature of the times ahead will be the growth of committee work in large factories (75), and that for two main reasons: ^{Handling of committees.} They afford the best means of encouraging team play and the more democratic method of handling affairs. By discussing joint tasks, men get a better insight into each other's difficulties and a better idea how other men overcome difficulties. In fact, when properly handled, committees can be a source of great strength to a concern. They permit of excellent opportunities for gentle educative, in-

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formative, and stimulative movements. I mean educative, informative, and stimulative to both management and managed.

To-day not one factory in a hundred makes anything like a full use of its collective brain power. The unapproachableness of the management generally keeps back many a bright idea, many an illuminating criticism, and causes many a fancied grievance to grow like a canker.

The war has surely taught us the supreme importance of every large body of people being actuated by mutually held ideals and aims: of subordinates knowing more of the aspirations of their leaders and feeling a conscious spiritual incentive towards communal service. More and more will factory managers have to formulate for the bulk of their people thoughts they cannot formulate for themselves, and endow them with perceptions and language wherewith to combat the insidious advances of wordy fanatics, while their subordinates will aspire to a bigger voice in the conditions that govern their working life.

Therefore, committee meetings, Whitley councils, trade parliaments, mass meetings, and all those other gatherings that establish healthy points of contact—those personal relationships that have a spiritual and not merely

SECURING COMMON VIEWPOINTS

an economic value—should be strongly encouraged. Incidentally, of course, this adds yet another to the lengthy list of a factory manager's necessary qualifications, namely, ability to preside over meetings efficiently. Good chairmanship is the first requisite for satisfactory committee work.

In three years, 13,757 workers of the United States Steel Trust are said to have served on committees with excellent results. Committees stimulate company spirit (p. 149). They can investigate, discuss, and come to majority decisions—those root foundations of common viewpoints! But they should appoint one man to act in all matters of action—one leader is better than forty. In other words, it is better to make most factory committees definitely advisory and not executive, at any rate in their initial stages.

Nor need this detract one iota from their effectiveness. In practice the responsible man will usually accept majority decisions, while getting men together to discuss questions of common interests, and so affording them an opportunity of determining working conditions and methods, will add much to the satisfaction that all good workers find in their work, and cause discipline to be largely self-enforced.

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Graphic
and
pictorial
repre-
sentation.

Still another development I am sure we all foresee is the increased use management will make of graphic representations (23). Instead of wading through lengthy lists of tabulated figures, future managers will gradually establish their own chart room. They may at first use the board room or the secretary's office, but eventually, I fancy, they will have a chart room, pure and simple, adjoining the statistical section—and this section will be charged with the task of graphically recording managerial information in such a way that outputs, costs, sales, prices, progress, efficiencies, markets, etc., can be quickly gleaned and their tendencies grasped.

Further, I can well imagine the chart room graphs being to a large extent superseded by cinematographic records, so that managers and foremen, and even mass meetings of the workers, can quickly picture an industry's progress and the results of their joint efforts.

Another use of the cinematograph, I foresee many large factories taking advantage of at no distant date, will be to find the best way of doing work, of cutting out superfluous motions (30), and of conserving the worker's health and strength (31). Then, if not before, the cinematograph will be widely utilised for teaching process work and otherwise generally

EXTERNAL PROBLEMS

aiding managers and operatives to increase production by disclosing defects now unsuspected. It is, after all, but a scientifically developed method of quick and continuous charting.

In passing, it may be noted that the bulletin board of modern progress departments, whether of railway roundhouses or the engineer's shop, is essentially a glorified movable graphic chart, a development of business methodology that facilitates the marshalling of forces for the more efficient transformation of energy into results.

There is one last task awaiting the future factory manager, to which I will allude in conclusion. And that is the need for a closer study of public opinion and its trend.

The trend of public opinion.

Society is applying the acid test of purpose more and more intensively to the activities of business. It is seeking a fairer balance between service and cost. It is raising a new set of problems external to the business. These are of growing importance; indeed, I might say, of immediate importance.

For a long time the fullest measure of competitive freedom was allowed the individual on the assumption that society was best served when man's initiative was given full play. The trend to-day is towards closer State regulation of economic activities; and since

SCIENTIFIC FACTORY MANAGEMENT

it is already a matter of growing concern to most industrial managers, let us see briefly how it comes about.

There are three stages. First of all, public opinion is roused against particular practices—especially when they react unfavourably on a large section of the community. I refer of course to the insane competition and the individual greed that grinds men down to living under slum conditions to the detriment of society, and in other ways, either actually or apparently, abuses the relationships between man and man. Public opinion has only to become sufficiently articulate for a restrictive law to be passed. If this is ineffective, Government control follows.

Nor has society itself been without blame. Consumers have always bought in the cheapest markets, and consequently so forced down prices in the less organised trades that sweating was the inevitable result.

Society, then, needs to know more of the activities and difficulties of business, of their relations and interdependences. It must be made to realise the necessity of paying a fair price for the services it gets; while the factory manager must see that his concern pays good wages for good employee service, in order that the employee families may live in comfort and

SERVING THE PUBLIC

pay fair prices for the goods they consume, and other people make.

But the responsibilities of the future factory manager won't end with paying good wages nor yet with the maintenance of comfortable working conditions after safeguarding profits. They will definitely comprise such external obligations as keeping in touch with the sentiments and aspirations of subordinates, studying and mitigating external prejudices, and seeing that his concern takes its rightful place as a social service unit (66).

It may sound like a fairy tale from Wales, but future factory managers will have to realise that the ultimate object of internal improvements is the reduction of cost to the public and not the mere increase of private profit. The world is in no mood to tolerate managers who are openly indifferent to the weal of worker and public, or who show themselves addicted to the worst practices of Victorian times, when sanctimonious Shylocks ruthlessly robbed the public on week-days under the cloak of alms and psalms on Sundays.

No, the day is not far distant when it will be accounted to a concern for righteousness and accredited to it for virtue that workers are anxious to find work within its walls and the public clamours for its goods and services.

SCIENTIFIC FACTORY MANAGEMENT

In short, business in its dealings with society will have to practise more consciously the great ethical principle of efficiency that makes for collective solidarity and the establishment of common viewpoints in joint action, namely,

THE FAIR DEAL

(1, 7, 24, 55, 66).

APPENDIX I

BOOK LIST AND TEXT REFERENCES

Nos. correspond to those bracketed in text.

No.	Writer.	Name of Book.	Publisher.
1	Emerson, Harrington .	Twelve Principles of Efficiency.	Indust. Mgt. Lib.
2	" "	Home Study Course of Personal Efficiency.	Efficiency Inst., N.Y. ; Efficiency Mag., W.C.
3	Taylor, F. W. .	Principles of Scientific Management.	Harper Bros.
4	" "	Shop Management.	"
5	Going, C. B. .	Principles of Industrial Engineering.	M'Graw-Hill
6	Jones, E. D. .	Administration of Industrial Enterprises.	Longmans
7	" "	The Business Administrator.	Indust. Mgt. Lib.
8	Webb, Sidney .	Works Manager of To-day.	Longmans
9	Church, A. H. .	Science and Practice of Management.	Indust. Mgt. Lib.
10	Smith, J. R. .	Elements of Industrial Management.	Lippincott
11	Duncan, J. C. .	Principles of Industrial Management.	Appleton
12	Casson, H. N. .	Factory Efficiency.	Efficiency Mag.
13	" "	Axioms of Business.	"
14	" "	Human Nature.	"
15	Hoxie, R. F. .	Scientific Management and Labour.	Appleton
16	Westaway, F. W. .	The Scientific Method.	Blackie
17	Thompson, C. B. .	Scientific Management.	Harvard University
18	Knoepfel, C. E. .	Installing Efficiency Methods.	Indust. Mgt. Lib.
19	McKillop, M. & A. D.	Efficiency Methods.	Routledge
20	Franklin, B. A. .	Experiments in Efficiency.	Indust. Mgt. Lib.
21	" "	Cost Reports for Executives.	"
22	Brinton, W. C. .	Graphic Methods for Presenting Facts.	"
23	Copeland, M. T. .	Business Statistics.	Harvard University
24	Shepard, G. H. .	Application of Efficiency Principles.	Indust. Mgt. Lib.
25	Gowin, E. B. .	The Executive and His Control of Men.	Macmillan
26	Hauer, D. J. .	Modern Management applied to Construction.	M'Graw-Hill
27	Elbourne, E. T. .	Factory Administration and Accounts.	Longmans
28	Gilbreth, F. B. .	Primer of Scientific Management.	Nostrand
29	" "	Motion Study.	"
30	" "	Applied Motion Study.	Routledge
31	Gilbreth, F. B. & L. M.	Fatigue Study.	"
32	Gilbreth, L. M. .	The Psychology of Management.	Sturgis and Walton
33	Munsterberg, H. .	Psychology and Industrial Efficiency.	Mifflin, N.Y.
34	Goldmark, J. L. .	Fatigue and Efficiency.	Russell Sage Founda- tion, N.Y.
35	Blackford, K. M. H. .	The Job, the Man, and the Boss.	Doubleday
36	" "	Analysing Character.	Alden
37	Spencer, H. M. .	The Study of Sociology.	Internat. Science Series
38	Scott, W. Dill .	Influencing Men in Business.	Ronald, N.Y.

SCIENTIFIC FACTORY MANAGEMENT

No.	Writer.	Name of Book.	Publisher.
39	M'Dougall, Wm.	Social Psychology.	Methuen
40	Taussig, F. W.	Inventors and Moneymakers.	Macmillan
41	"	Principles of Economics (vol. ii. p. 164).	"
42	Comte, Auguste.	Social Philosophy.	Universal Lib.
43	Haddock, H. C.	Business Power.	Pelton, Conn.
44	Kidd, Benjamin	Science of Power.	Methuen
45	"	Social Evolution.	Macmillan
46	Cole, G. D. II.	Introduction to Trade Unionism.	Allen & Unwin
47	"	Payment of Wages.	"
48	"	Self-Government in Industry.	Bell
49	Proud, Dorothea	Welfare Work.	"
50	Orage, A. R.	National Guilds.	"
51	Penty, A. J.	Old Worlds for New.	Allen & Unwin
52	Bentinck, Lord Henry	Tory Democracy.	Methuen
53	Deeley, W. J.	Labour Difficulties and Suggested Solutions.	Sherratt & Hughes
54	Leverhulme, Lord	The Six-Hour Day.	Allen & Unwin
55	Lewis, St. Elmo	Getting the Most out of Business.	Ronald, N.Y.
56	Beresford & Richmond	W. E. Ford.	Collins
57	Marden, O. S.	Cheerfulness as a Life Power.	Rider
58	Turner, Samuel	From War to Work.	Nisbet
59	Hichens, W. L.	Some Problems of Modern Industry.	"
60	Spooner, H. J.	Waste.	Routledge
61	"	Industrial Fatigue.	"
62	Stein, L.	Buying Brains.	Authors' Press, N.Y.
63	Withers, Hartley	Business of Finance.	Murray
64	Gantt, H. L.	Work, Wages, and Profit.	Indust. Mgt. Lib.
65	Atkinson, H.	Rational Wages System.	Bell
66	Shaw, A. W.	An Approach to Business Problems.	Harvard University
67	Brandeis, L. D.	Business a Profession.	Small, Maynard
68	Brisco, N. A.	Economics of Efficiency.	Macmillan
69	Cowie, G. A.	Practical Safety Methods and Devices.	Routledge
70	Barker, J. Ellis	Economic Statesmanship.	Murray
71	Shadwell, A.	Industrial Efficiency.	Longmans
72	Scott, W. Dill	Increasing Human Efficiency in Business.	Macmillan
73	Hollingsworth, H. L.	Vocational Psychology.	Appleton
74	Pound, A. D.	Man-of-War Organisation.	Hogg
75	Carpenter, C. U.	Profit-Making Management.	Indust. Mgt. Lib.
76	Dalley, W. J.	Life of W. J. Davies.	Birmingham Printers
77	Galloway, Lee	Office Management.	Ronald, N.Y.

"Indust. Mgt. Lib." is an abbreviation for Industrial Management Library, New York.

PAMPHLETS

78	Bristol Conference	Industrial Outlook (6d.).	Arrowsmith
79	Foster, T.	Masters and Men (3d.).	Headley
80	Hichens, W. L.	Government in Relation to Industry.	Whitehead
81	O. P. I. P.	No Man's Land (1d.).	Athenæum
82	Hutchins, B. L.	Women in Industry (6d.).	"
83	Cole, etc.	Some Problems of Industry (1s.).	Ruskin College, Oxford
84	Labour Party	Social Reconstruction (1d.).	"
85	I.L.P.	The Mineowners in the Dock (2d.).	"
86	Cole and Mellor	Meaning of Industrial Freedom (1s.).	Herald Press
87	Bowling, A. L.	Division of the Product of Industry (2s. 6d.).	Clarendon Press

APPENDIX I

GOVERNMENT PUBLICATIONS

- 88 Industrial Efficiency and Fatigue. (1s. 3d.) (Cd. 8511.)
- 89 Industrial Fatigue by Physiological Methods. (1s. 6d.) (Cd. 8335.)
- 90 Ventilation of Factories and Workshops, Pt. II. (4s. 5d.) (Cd. 3553.)
- 91 Whitley Councils and Works Committees. (1d. ea.) (Cd. 8606, 9001-2.)
- 92 Whitley Reports on Conciliation, Employer-Employed Relations. (Cd. 9099, 9153.)
- 93 Industrial Diseases. (1d.) Sickness and Injuries. (1½d.) (Cd. 8214, 8216.)
- 94 Canteen Construction. (4½d.) Workers' Food, etc. (1½d.) (Cd. 8199, 8370.)
- 95 Washing Facilities and Baths. (1d.) (Cd. 8387.)
- 96 Output in Relation to Hours of Work. (1½d.) (Cd. 8344.)
- 97 Industrial Conditions on Eyesight. (1d.) (Cd. 8409.)
- 98 Ministry of Labour—Industrial Reports on Works Committees.
- 99 U.S. Bureau of Standards Annual Report. (Washington.)

APPENDIX II

WHAT IS THE MOST VITALLY IMPORTANT REQUIREMENT OF BRITISH INDUSTRY AT THE PRESENT TIME?

The following table reflects the varied experiences of two large audiences, differently canvassed for their opinions. The results are not strictly comparable, nor can they be taken as fully indicative of the mature thought of either audience. The figures are instructive as affording clear illustration of the surprising diversity of views held in industrial circles and indicating the inherent difficulty of getting large bodies of men to agree on details. Moreover, they drive home very forcibly the present need of energetic propaganda on broad issues. They represent the summarised voting :—

(a) At Nottingham Branch of Society of Chemical Industry—22nd January 1919.

(b) At an open meeting of Industrial Administration Department, Manchester College of Technology, 19th November 1918.

	Nottingham "Preferences."				Manchester "Nominations."	
	1.	2.	3.	Total.		
CAPITAL AND LABOUR ISSUES—						
Mutual co-operation . . .	10	17	5	32	...	16
Mutual consideration . . .	12	6	4	22	...	4
Increased harmony . . .	1	—	3	4	...	20
Better understanding . . .	8	7	8	23	...	2
Frequent conferences . . .	5	7	14	26	...	1
Profit-sharing . . .	2	—	—	2	...	—
Section Totals . . .	38	37	34	109		43
INDUSTRIAL ADMINISTRATION—						
Better organisation . . .	2	10	11	23	...	31
Better management . . .	5	—	1	6	...	9
Scientific management . . .	17	12	7	36	...	4
Skilled leadership . . .	8	12	13	33	...	3
Section Totals . . .	32	34	32	98		47
TECHNICAL DETAILS—						
Increased production . . .	5	2	10	17	...	11
More research work . . .	19	8	15	42	...	2
Better training of workers . . .	8	24	3	35	...	19
More information to ditto . . .	3	5	12	20	...	21
Section Totals . . .	35	39	40	114		34

APPENDIX II

	Nottingham "Preferences."				Manchester "Nominations."	
	1.	2.	3.	Total.		
INDIVIDUAL QUALITIES—						
Imagination	18	12	8	38	...	18
Open-mindedness . . .	4	6	4	14	...	2
Fair dealing	15	9	5	29	...	5
Clearer thinking . . .	4	2	1	7	...	3
Greater activity . . .	1	8	1	10	...	2
More concentration . .	1	3	14	18	...	2
More "brains"	1	1	6	8	...	4
Section Totals . . .	44	41	39	124		46
STATE ASSISTANCE—						
Improved education . .	22	14	9	45	...	19
Protection against foreigners .	3	2	1	6	...	1
Capital advances . . .	—	1	8	9	...	3
Endowment of research .	7	12	8	27	...	10
Encouragement of inventors .	5	6	12	23	...	2
Section Totals . . .	37	35	38	110		35½
Grand Totals . . .	186	186	183	555		205

At Manchester the audience was given the bare question, and the replies were subsequently classified under main headings—most of these admittedly overlap or are what logicians call cross-divisions. At Nottingham the members were asked to indicate their first, second, and third preferences in accordance with the above list, exclusive of Profit-sharing.

The Manchester audience put Better Organisation at the head of the poll, with Industrial Harmony and Training of Workers second, and Improved Education and Imagination as runners-up for third place. The Nottingham audience gave first preference to Improved Education, Research, and Imagination, second preference to Training of Workers and Industrial Co-operation, and third preference somewhere around Research, Frequent Conferences, and Skilled Leadership.

In fact, the one may be described as an Organisation vote and the other as an Education vote. Both terms are of course very comprehensive and mutually interdependent. Personally, I place Imagination first, Organisation second, and Education third.

Imagination is the creative spirit of the future that shapes the things of to-day. It liberates men from the tyranny of worn-out methods and habits, and shows them how to do things in a better, quicker, cheaper, and easier way. It guides the pioneer, the inventor, the promoter, the educator, and the organiser. And the scientific factory manager must be something of all five.

APPENDIX III—CLASSIFICATION

Based on analysis by United States Bureau
CLASSIFICATION

1

STANDARDS OF MEASUREMENTS

Reference and working standards for measurements of all kinds for expressing the quantitative aspects of space, time, matter, energy, motion, and of their inter-relations.

E.g., by definition, specification, or material standard, covering length, area, and volume ; mass, weight, density, and pressure ; heat, light, electricity, and radio-activity ; and including quantity, flux, intensity, etc.

2

STANDARD CONSTANTS

Measured numerical data as to materials and energy, or the fixed points or quantities which underlie scientific research and industrial processes when scientifically organised.

E.g., specific densities, viscosities ; melting and boiling points ; heat capacity ; heats of combustion ; mechanical equivalents of heat, light, and electricity and gravitation ; velocity of propagation of light ; conductivities of materials to heat, light, and electricity ; tensile strength and atomic weights and many similar magnitudes determined experimentally with maximum precision and referred to fundamental standards of measure.

3

STANDARDS OF QUALITY

Specifications for material by description, sample, or both, fixing in measurable terms a property or group of properties which determine the quality.

E.g., numerical magnitude of each constituent property pertinent to the quality involved, in unity of measure of such significant factors as uniformity, composition, form, structure, etc.

4

STANDARDS OF PERFORMANCE

Specification of operative efficiency or action, for machines, devices, and persons, specifying the factors involved in terms susceptible of measurement.

E.g., numerical statement of speed, uniformity, output, economy, durability, or other factors, which together define the net efficiency of an appliance, machine, or person.

5

STANDARDS OF PRACTICE

Codes and rules impartially analysed and formulated after study and experiment for the better technical regulation of construction, installation, operation, etc., and based upon standards of measurement, quality, and performance.

E.g., collation of standard data, numerical magnitudes, and ranges of the pertinent factors defining quality, safety, economy, convenience, and efficiency.

AND PURPOSE OF STANDARDS.

of Standards—Annual Report, 1918.

PURPOSE

- { To PROMOTE JUSTICE IN DAILY LIFE through systematic inspection and regulation ;
- { To facilitate PRECISION IN SCIENCE and TECHNOLOGIC RESEARCH through calibration of units, measures, and instruments involved ;
- { To aid ACCURACY IN INDUSTRY through uniform and correct measures ;
- { To ASSIST COMMERCE IN SIZE STANDARDISATION of containers and products.

- { To SERVE as an EXACT BASIS for scientific study, experiment, computation, and design ;
- { To AID RESEARCH BY REDUCING ERRORS and uncertainty caused by use of data of doubtful accuracy ;
- { To FURNISH an EFFICIENT CONTROL for industrial processes in securing reproducible and uniformly high quality in output ;
- { To SECURE UNIFORMITY OF PRACTICE in graduating measuring instruments, compiling tables, in standards of quality and performance —and wherever uniformity is desirable.

- { To furnish a SCIENTIFIC BASIS for FAIR DEALING to avoid disputes or settle differences ;
- { To PROMOTE PRECISION and AVOID WASTE in science and industry, by affording quality standards by which materials may be made, sold, and tested ;
- { To secure HIGH UTILITY in the PRODUCTS of industry by setting an attainable standard of quality ;
- { To PROMOTE TRUTHFUL BRANDING and ADVERTISING by suitable standards and methods of test.

- { To CLARIFY THE UNDERSTANDING between maker, seller, buyer, and user, as to operative efficiency of appliances and machines ;
- { To make EXACT KNOWLEDGE the BASIS of the buyer's choice, the manager's decision, and the worker's judgment ;
- { To STIMULATE AND MEASURE MECHANICAL PROGRESS ;
- { To PROMOTE and MEASURE managerial and operative EFFICIENCY.

- { To ENSURE EFFECTIVE DESIGN and INSTALLATION of utilities of all kinds ;
- { To FURNISH for each utility a single IMPERSONAL STANDARD of practice as a BASIS for AGREEMENT of all interests clearly defined in measurable terms ;
- { To PROMOTE SAFETY, EFFICIENCY, and CONVENIENCE in the MAINTENANCE and OPERATION of such utilities ;
- { To SECURE UNIFORMITY OF PRACTICE where such is practicable, and EFFECTIVE ALTERNATIVES in other cases.

